**Final Draft**

# ENVIRONMENTAL ASSESSMENT FOR THE CONSTRUCTION, MODIFICATION, AND OPERATION OF THREE FACILITIES IN SUPPORT OF THE CONSTELLATION PROGRAM, JOHN F. KENNEDY SPACE CENTER, FLORIDA

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**FINAL DRAFT**

# DRAFT ENVIRONMENTAL ASSESSMENT
## FOR THE CONSTRUCTION, MODIFICATION, AND OPERATION OF THREE FACILITIES IN SUPPORT OF THE CONSTELLATION PROGRAM,

# JOHN F. KENNEDY SPACE CENTER, FLORIDA


### Abstract

This Environmental Assessment addresses the potential impacts associated with two alternative actions evaluated for the commencement of the Constellation Program on Kennedy Space Center. The No Action alternative states that no facilities would be constructed or modified to support the Constellation Program, thereby delaying or preventing its implementation. The Proposed Action alternative addresses three activities that must be started before the anticipated completion of the Constellation Programmatic Environmental Impact Statement in June 2008. These activities are modifying the existing the Launch Complex (LC) 39B tower, construction of a Lightning Protection System around the LC 39B launch pad, and fabricating a new Mobile Launcher. Most of the environmental impacts from these activities were classified as "none" or "minimal", but some of the impacts could potentially be major. Mitigation techniques are proposed that would be expected to reduce the potential major impacts to a minor level. Monitoring plans to assess the effectiveness of the mitigation are also presented.



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# List of Abbreviations and Acronyms

| | |
|---|---|
| ac. | acres |
| C | centigrade |
| CatEx | Categorically Excluded |
| CCAFS | Cape Canaveral Air Force Station |
| cm | centimeters |
| CNS | Canaveral National Seashore |
| dBA | decibels, A-weighted |
| E | Endangered |
| EA | Environmental Assessment |
| ECS | Environmental Control System |
| EDS | Earth Departure Stage |
| EIS | Environmental Impact Statement |
| EO | Executive Order |
| EPA | Environmental Protection Agency |
| F | Fahrenheit |
| FAA | Federal Aviation Administration |
| FPL | Florida Power and Light |
| FSS | Fixed Service Structure |
| ft. | foot/feet |
| gal. | gallons |
| GOX | gaseous oxygen |
| ha | hectares |
| ISS | International Space Station |
| in. | inch |
| IRL | Indian River Lagoon |
| km | kilometers |
| KSC | Kennedy Space Center |
| kV | kilovolt |
| l | liters |
| LC | Launch Complex |
| LPS | Lightning Protection System |
| LSAM | Lunar Surface Access Module |
| m | meters |
| mi. | miles |
| MINWR | Merritt Island National Wildlife Refuge |
| ML | Mobile Launcher |
| MLP | Mobile Launch Platform |
| NASA | National Aeronautics and Space Administration |
| NEPA | National Environmental Policy Act |
| NPS | National Park Service |
| OSHA | Occupational Safety and Health Administration |
| PAMS | Permanent Air Monitoring System |
| PM-10 | 10-micron particulates |
| SR | State Route |
| $SO_2$ | sulfur dioxide |

| | |
|---|---|
| SWMU | Solid Waste Management Unit |
| T | Threatened |
| U.S. | United States |
| USFWS | U.S. Fish and Wildlife Service |
| VAB | Vehicle Assembly Building |

# EXECUTIVE SUMMARY

This Environmental Assessment (EA) has been prepared in compliance with the National Environmental Policy Act of 1969 (NEPA), as amended (42 U.S.C. §§ 4321-4370d) and according to the Procedures of Implementation of NEPA for National Aeronautics and Space Administration (NASA) [Title 14, Code of Federal Regulations, part 1216 subparts 1216.1 and 1216.3].

**Purpose and Need**

In order for NASA to implement the proposed Constellation Program, modifications to existing Space Shuttle facilities are required. The environmental impacts of those modifications and the operations of new launch vehicles are being assessed as part of a Programmatic Environmental Impact Statement (EIS) expected to be published in late 2007 or early 2008. To meet the proposed Constellation Program development schedule, however, there are several projects that must be started at the Kennedy Space Center (KSC) prior to the completion of the Programmatic EIS due to their complexity or long duration required for implementation, or to meet the accelerated schedule of the first test launch of the new Constellation vehicle, the Ares I. The purpose of this EA is to document potential impacts from those projects and the proposed mitigations for them.

There are several proposed activities to support the Constellation Program that would require an early construction start that are not included in this EA (modifications to the Mobile Launch Platform, Launch Control Center Firing Room 1, the High Bay in the Operations and Checkout Building, and Hangar AF on Cape Canaveral Air Force Station). It is the result of early review and determinations that each of these projects posed little to no environmental impacts and could be Categorically Excluded (CatEx) from further NEPA review.

**Proposed Action and Alternative**

Two alternative actions were analyzed and are presented. The first is the No Action alternative, and the second is the Proposed Action alternative. Within the Proposed Action, there are several activities.

The No Action alternative states that the early development, modification, and operation of facilities to support Ares launches for the Constellation Program would not occur at KSC. When the Shuttle program is completed in 2010, many facilities, including those addressed in this EA, would either be maintained at a reduced level, maintained in long-term storage mode, or disassembled.

Under the Proposed Action alternative, three activities would occur: a new Mobile Launcher (ML) would be constructed, the existing Launch Complex (LC) 39B launch tower would be modified for the test launch of the Ares-I vehicle, and a Lightning Protection System (LPS) consisting of three towers would be erected within the perimeter of LC 39B.

**Affected Environment and Consequences**

KSC encompasses nearly 56,000 ha (140,000 ac.) on the east coast of central Florida. Approximately 2,500 ha (6,000 ac.) of KSC are actively used to support space mission operations, with the remaining lands being managed as wildlife habitat. Resources identified that could be impacted by either of the two action alternatives include air quality, wildlife, threatened and endangered species, geology and soils, noise, groundwater quality, and socioeconomics.

Potential impacts to resources resulting from the implementation of the two alternatives were identified and placed into the following pre-determined classifications: none, minimal, minor, or major. Under the No Action alternative, socioeconomics would be the only resource potentially affected. These impacts could be major due to the anticipated loss of jobs at KSC, and the primary and secondary effects on the economy of the surrounding area.

Some impacts from construction and/or operation of one or more of the three activities under the Proposed Action alternative were classified as none under the categories of habitats/vegetation, wildlife, threatened and endangered species, cultural resources, geology and soils, noise, surface water quality, groundwater quality, and socioeconomics. Proposed activities would be confined to areas that are already developed and undisturbed areas would not be affected. Some minimal effects would be expected for air, wildlife, geology and soils, noise, and groundwater quality, but these would be localized and temporary. Minimal effects would also be expected to the socioeconomics of the area because the addition of construction activities would input monies into the local economy. Some impacts to wildlife and threatened and endangered species could potentially occur, but are expected to be minor if the proposed mitigation strategies are implemented. These impacts would be anticipated during the modification of the launch tower, and during construction and operation of the LPS. Lighting associated with these activities could potentially disorient adult and hatchling sea turtles on the adjacent nesting beach. Upon completion of the LPS, the tall lit towers and associated grounding wires could also pose strike risks to migrating birds flying along the coast at night and birds flying through the launch pad area during the day.

A number of mitigation strategies were proposed for the design and operation of the LPS to reduce impacts. Those mitigations that would be implemented are anticipated to reduce impacts to a minor level. These include: 1) using the minimum number and height of towers possible; 2) having the LPS towers oriented so that only one leg of the tower triangle is located near the beach; 3) using the minimum number of grounding wires of the greatest diameter and most visible material feasible; 4) minimization of FAA-required lighting, using white lights flashing at 40 flashes/minute; 5) minimization of task lighting, equipped with on-off switches and timers; and 6) adherence to the KSC Exterior Lighting Guidelines whenever possible. In addition, a monitoring program to evaluate the effectiveness of the mitigation strategies is proposed for sea turtle disorientations and bird strikes.

Neither the No Action alternative nor the Proposed Action alternative would be expected to produce any consequences related to Environmental Justice as all activities are located away from population centers. The Constellation Program would not be expected to affect the surrounding communities any differently than the current programs at KSC.

# 1.0 Purpose and Need for Action

This Environmental Assessment (EA) has been prepared in compliance with the National Environmental Policy Act of 1969 (NEPA), as amended (42 U.S.C. §§ 4321-4370d) and according to the Procedures of Implementation of NEPA for National Aeronautics and Space Administration (NASA) [Title 14, Code of Federal Regulations, part 1216 subparts 1216.1 and 1216.3]. Chapter 1 describes the purpose and need for proposed facility construction and modifications, and operation of those facilities, to support the Constellation Program at John F. Kennedy Space Center (KSC), Florida (Figure 1-1). Chapter 2 describes the two reasonable alternatives considered: 1) no action; or 2) develop the infrastructure necessary for the Constellation Program to proceed. Several different development activities are included in this EA, and additional alternatives exist within some of those activities. Chapter 3 describes existing conditions in the environment. Chapter 4 analyzes the potential environmental consequences for each alternative.

## 1.1 Background

The Vision for Space Exploration (NASA 2004a) calls for humans to return to the moon by the end of the next decade, paving the way for eventual journeys to Mars and beyond. The completion of the International Space Station (ISS) and retirement of the Space Shuttle fleet by 2010 necessitate an innovative plan and program to fulfill the goals of the Vision. NASA's Constellation Program, a family of new spacecraft, launchers, and associated hardware, would facilitate a variety of manned and unmanned missions, from ISS re-supply to lunar and planetary landings.

The new crew transportation system, which uses both Earth Orbit Rendezvous and Lunar Orbit Rendezvous techniques, can be categorized into three parts: The Orion Crew and Service Modules, the Lunar Surface Access Module (LSAM), and the Earth Departure Stage (EDS). The rockets to be used for launching the different components consist of the Ares V (for the EDS and either the LSAM or cargo), and the Ares I for the Orion spacecraft (Figure 1-2).

Much of the Constellation hardware is based on systems originally developed for the Space Shuttle, although the Orion Spacecraft (formerly the "Crew Exploration Vehicle" or CEV), is heavily influenced by the earlier Apollo spacecraft design, consisting of a two-part crew and service module system. In addition, the Ares I, the upper stage of the Crew Launch Vehicle, is a new design being developed in-house by NASA.

## 1.2 Purpose of and Need for Action

NASA’s mission is:

- To advance and communicate scientific knowledge and understanding of the earth, the solar system, and the universe;
- To advance human exploration, use, and development of space; and
- To research, develop, verify, and transfer advanced aeronautics and space technologies.
- KSC has a unique role in the pursuit of NASA’s mission. KSC serves as NASA’s launch and primary landing site for the Space Shuttle, oversees and manages expendable launch vehicle missions which are launched from the adjacent Cape Canaveral Air Force Station (CCAFS) and Vandenberg Air Force Base, and is the gateway to the

ISS for most of its major elements and continuing missions. The Constellation Program would be NASA's predominant mechanism for human exploration and utilization of space once the Space Shuttle program is phased out. KSC's participation in the Constellation Program is fundamental. The facility construction, modifications, and operation analyzed in this EA are the first steps toward fulfilling KSC's role as the lead NASA center for the launches of the Constellation Program.

The Constellation Program is scheduled to be completed in phases over several decades, and a Constellation Programmatic Environmental Impact Statement (EIS) Notice of Intent was published in September 2006. The anticipated completion date of the EIS is no later than June 2008. However, in order to meet the aggressive schedule necessary to develop the Constellation Program in time to succeed the Space Shuttle program, some facility construction and modifications at KSC must begin before EIS completion. Specifically, NASA proposes to conduct its first test flight of the Ares I system in 2009. In order to support this schedule, NASA must begin facility modifications in 2007. Those activities proposed to start before 2008 are listed in Table 1-1. If these facility enhancements are not begun early, the test flight and, subsequently, the overall schedule of the Constellation Program would be delayed.

## 1.3 Scope of EA

This EA addresses only those proposed facility modifications that are required for early start to support the first Ares I test flight, and other activities that also require an early start due to their complexity or long duration required for implementation. There are several proposed activities to support the Constellation Program that would require an early construction start that are not included in this EA. This is the result of early review and determinations that each of these projects posed little to no environmental impacts and could be Categorically Excluded (CatEx) from further NEPA review. These include:

- modifications to Firing Room 1 in the Launch Control Center
- modifications to the existing Mobile Launch Platform
- modifications to the high bay of the Operations and Checkout Building
- modifications and maintenance activities at the Hangar AF complex on CCAFS

Documentation for these CatEx activities is in Appendix 1.

Eleven broad categories of resources that could potentially be impacted by alternative actions are typically considered in EAs and EISs: Facilities and Infrastructure, Air Quality, Biological Resources, Threatened and Endangered Species, Cultural Resources, Geology and Soils, Noise, Surface Water Quality, Ground Water Quality, Socioeconomics, and Land Use. Of these eleven, impacts for two categories (Facilities and Infrastructure, and Land Use), and one sub-category (Habitats/Vegetation under the Biological Resources category) were determined to be unaffected by the proposed alternatives (Table 1-2).

### 1.3.1 Facilities and Infrastructure (Transportation and Utilities)

None of the activities analyzed here would adversely affect existing transportation routes or capabilities, and no additional routes would be needed. Any supplementary utility

infrastructure would be installed within areas that are already being used for that purpose and would not constitute a land use change.

### 1.3.2 Land Use

Land Use has been eliminated from further analysis because none of the activities would affect a change in how this resource is currently being used.

### 1.3.3 Biological Resources (Habitats and Vegetation)

None of the activities would occur in natural habitats that constitute wetlands or floodplains, nor would there be any impact to natural vegetation.

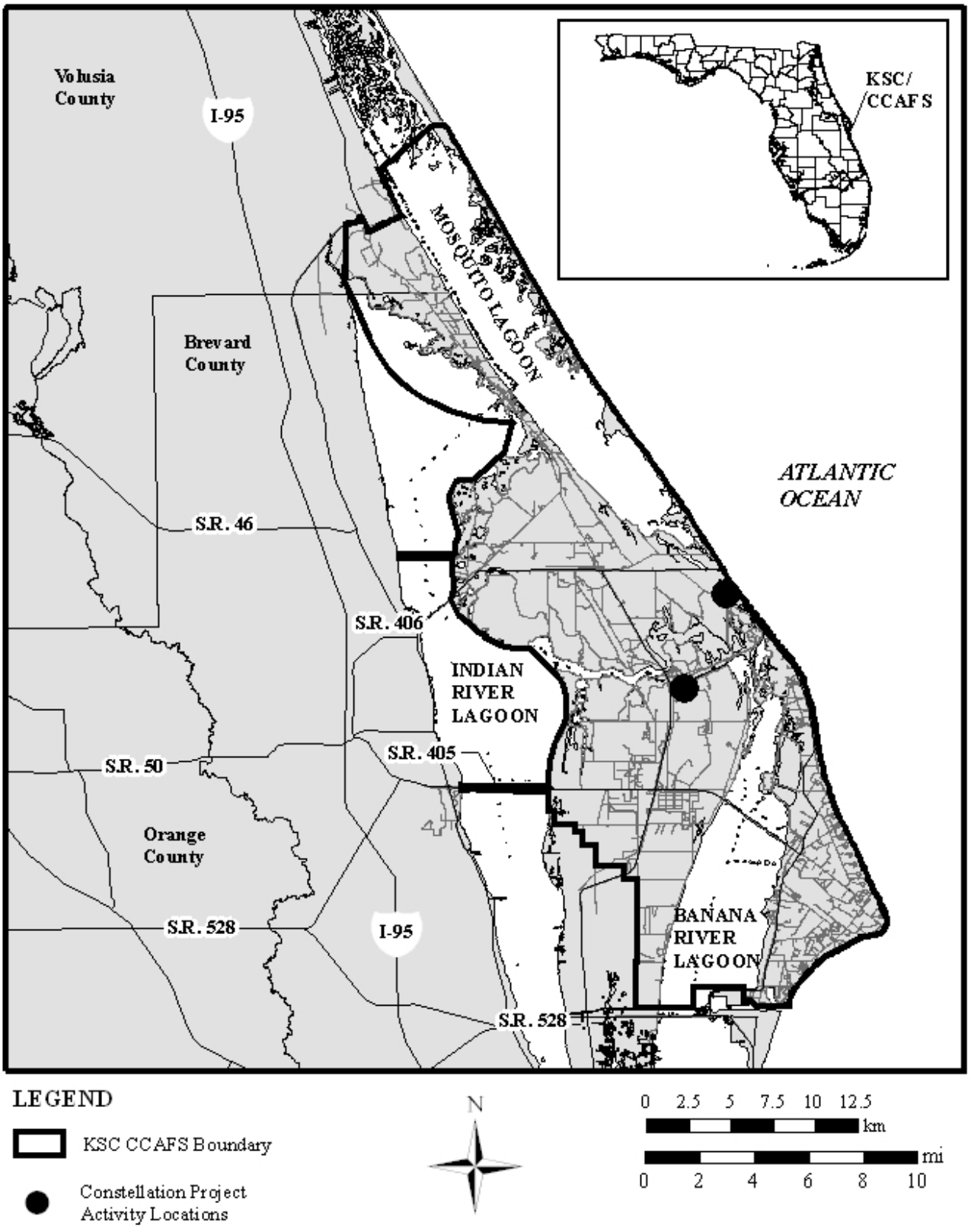


Figure 1-1. Proposed Constellation project activity locations on KSC, Florida.

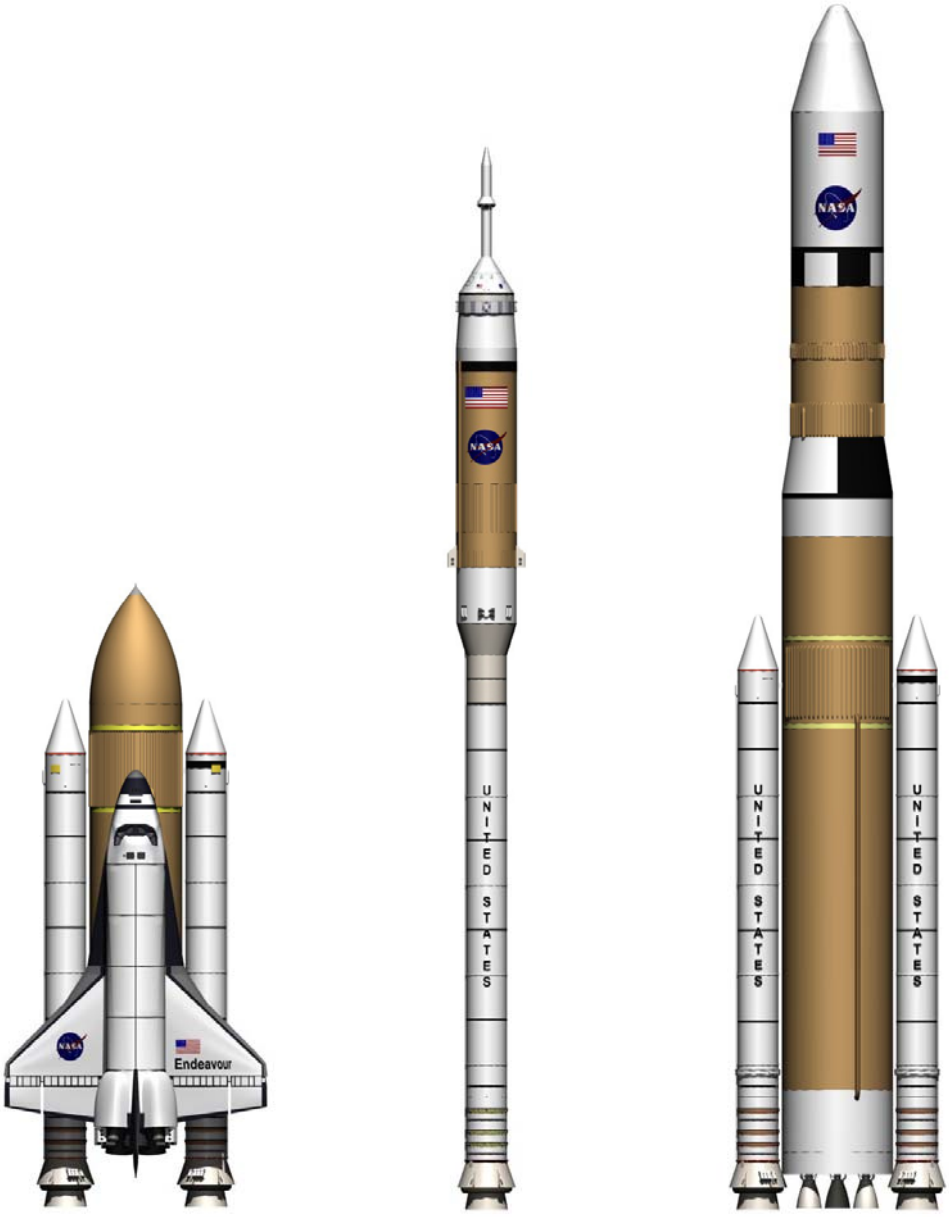


Figure 1-2. Proposed Constellation Program launch vehicles Ares I (crew, center) and Ares V (cargo, right) shown with the Space Shuttle (left). Source: www.NASA.gov.

Table 1-1: Proposed Constellation Program activities, associated functions, and locations.

| Activity | Function | Location |
|---|---|---|
| *Construct Mobile Launcher (ML)* | Platform used to transport launch vehicle from Vehicle Assembly Building (VAB) to launch pad | Parked adjacent to VAB |
| *Modify LC 39B Tower* | Launch platform | LC 39B |
| *Construct Lightning Protection System (LPS)* | Lightning protection for pad personnel and launch vehicle | Periphery of LC 39B launch pad structure |

Table 1-2: Resources analyzed and eliminated from Constellation Program EA.

| Resource | Analyzed in EA | Eliminated from Analysis |
|---|---|---|
| Facilities and Infrastructure | | |
| *Transportation* | | √ |
| *Utilities* | | √ |
| Air Quality | √ | |
| Biological Resources | | |
| *Habitats/Vegetation* | | √ |
| *Wildlife* | √ | |
| Threatened and Endangered Species | √ | |
| Cultural Resources | √ | |
| Geology and Soils | √ | |
| Noise | √ | |
| Surface Water Quality | √ | |
| Ground Water Quality | √ | |
| Socioeconomics | √ | |
| Land Use | | √ |

# 2.0. Alternative Actions

Chapter 2 describes the two alternative actions that were analyzed and are presented in this EA. The first is the No Action alternative, and the second is the Proposed Action alternative. Within the Proposed Action, there are several activities (Table 1-1).

## 2.1 No Action Alternative

The No Action alternative states that the early development, modification, and operation of facilities to support the Constellation Program would not occur at KSC. The facilities included in the proposed action are the Mobile Launcher (ML) and Launch Complex (LC) 39B (Figure 2-1). All of these areas are used to support the Space Shuttle program. There are currently no other plans for using these facilities when the Space Shuttle program is completed in 2010, so presumably, under this alternative, they would either be maintained at a reduced level, maintained in long-term storage mode, or disassembled.

## 2.2 Proposed Action Alternative

Three activities would be included in the Proposed Action alternative: 1) the LC 39B tower would be modified; 2) a Lightning Protection System (LPS) would be built around the LC 39B launch pad; and 3) a new ML would be constructed.

### 2.2.1 LC 39B

LC 39 consists of two launch pads (LC 39A and LC 39B) and their surrounding facilities. The complexes were originally used for the Apollo program beginning in 1967 and were subsequently used for Shuttle launches beginning in 1981. The Constellation Program would eventually use both LC 39 pads, but LC 39B is proposed to be modified first in order to support launch of Ares I, and these proposed modifications are addressed in this EA.

Two modification activities are proposed for LC 39B: 1) tasks taking place on the launch tower itself; and 2) construction/installation of a LPS around the launch pad.

#### 2.2.1.1 Launch Tower Modifications

Three modifications/additions that are proposed for the Fixed Service Structure (FSS) to support Ares I are addressed in this EA:

1) In order to provide cooling to the launch vehicle while it is on the pad, the Environmental Control System (ECS) would be modified. An existing duct would be extended from the 195 foot/feet (ft.) level to the 255 ft. level. At that point, a metal duct with two support structures housing a flexible hose would be built from the FSS to an attachment point on the launch vehicle. Two lanyards would hang below the duct system; these lanyards would fasten to the attachment point on the vehicle and would disconnect and retract the ECS duct and hose from the vehicle at T-0 (launch);

2) The GOX (gaseous oxygen) vent arm would be modified to provide personnel access to the interstage of the vehicle. It would also be used as the route for propellant transfer from the FSS to the vehicle. Portions of the arm (including the “beanie cap”) would be removed and stored on KSC for use as spare parts for LC 39A, and an extension would be added to the arm so that it is long enough to reach the vehicle;

3) The third task taking place on the launch tower is the addition of a personnel access arm to the forward skirt. An access arm has been acquired from Vandenberg Air Force Base and is currently being stored at KSC. It would

be modified and added to the FSS between the 235 ft. and 255 ft. levels.

All of these modifications/additions would require some welding, drilling, and use of a crane to lift equipment and materials to their proper positions.

#### 2.2.1.2 Lightning Protection System

Florida is known as the "lightning capital" of the United States (U.S.), receiving over a million cloud-to-ground lightning strikes each year (NOAA 2007). Brevard County is located in one of the primary strike areas and is subjected to thousands of strikes during some months (Table 2-1). The existing LPS at LC 39B is not configured properly to adequately protect the Constellation vehicles. A new LPS would be required to safeguard all launch complex facilities, vehicles, and personnel from the dangers associated with lightning. The proposed LPS would consist of three free-standing towers approximately 184 meters (m) (605 ft.) tall with a network of nine grounding cables extending between the towers and to the ground. The towers would be 24 m (80 ft.) apart, forming an equilateral triangle around the launch pad surface. Each tower would be constructed of steel to a height of 161 m (528 ft.). The remaining 23 m (77 ft.) would be a fiberglass cone needed to insulate the steel tower from direct lightning strikes (Figure 2-2). All towers would be equipped with a man lift, ladders, electrical systems, communications systems, and Federal Aviation Administration (FAA)-mandated lighting. The location of the LPS within the complex is shown in Figure 2-3.

### 2.2.2 Mobile Launcher

The proposed ML is the platform and tower (including their systems and equipment, Figure 2-4) used to assemble, test, check out, service, transfer to the pad, and launch all of the components included in the Constellation Program. The program plan calls for building a new ML to support launches.

Part of the new ML fabrication would be done off-site and the parts transported to KSC. Construction done on-site would also take place at either Park Site 1 or 3, and the adjacent lots would be used as laydown areas. Qualification testing of critical components and subsystems would be done at the Launch Equipment Test Facility and other appropriate facilities, as necessary.

As the ML is constructed, the tower would eventually reach a height of approximately 122 m (400 ft.). While at the Park Site, FAA-required lighting would be installed. Once construction is completed, most of the time the ML would either reside at a launch pad or inside the Vehicle Assembly Building (VAB).

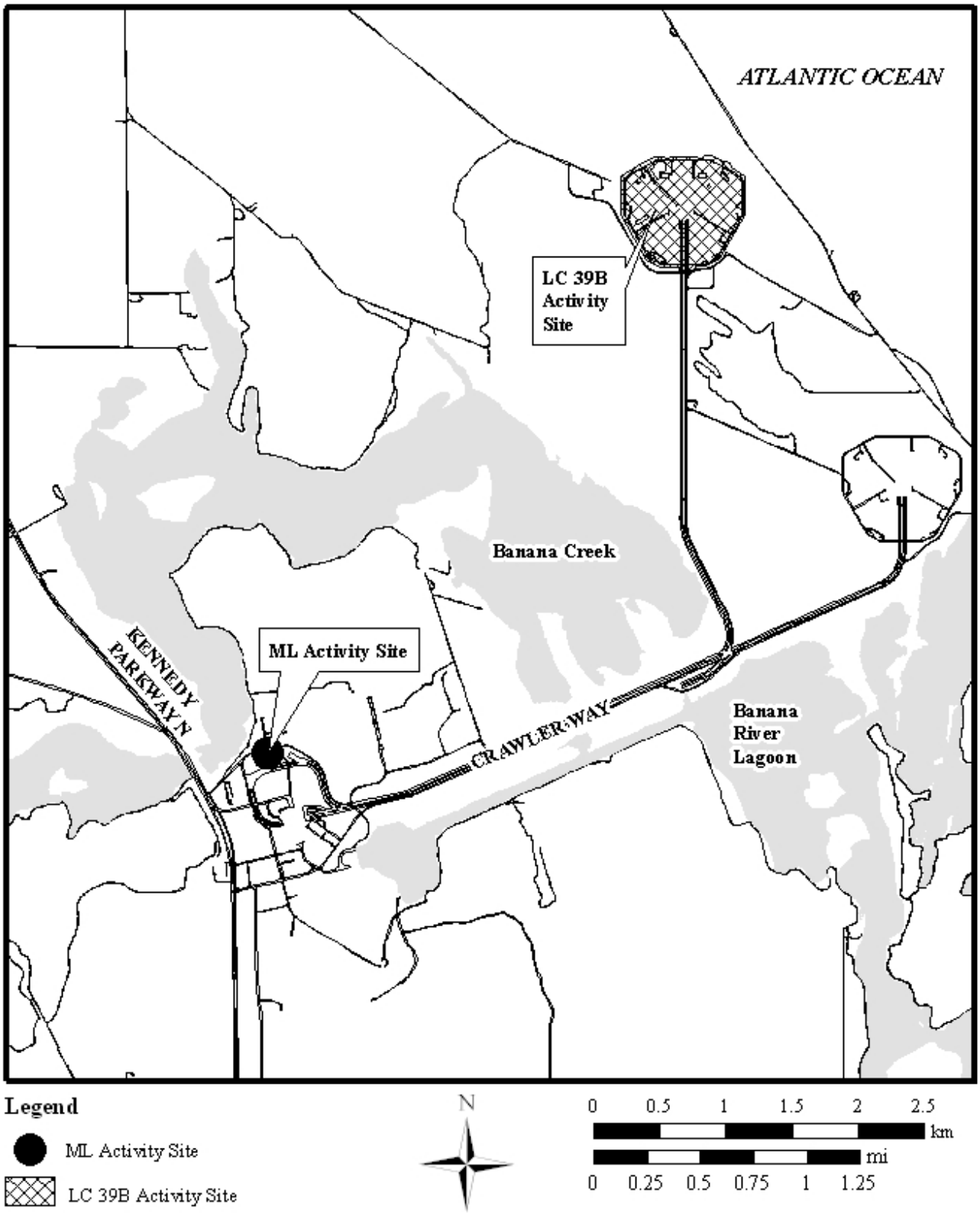


Figure 2-1. Proposed ML and LC 39B activity sites on KSC, Florida.

Figure 2-2. Proposed Lightning Protection System configuration, LC 39B, KSC, Florida.

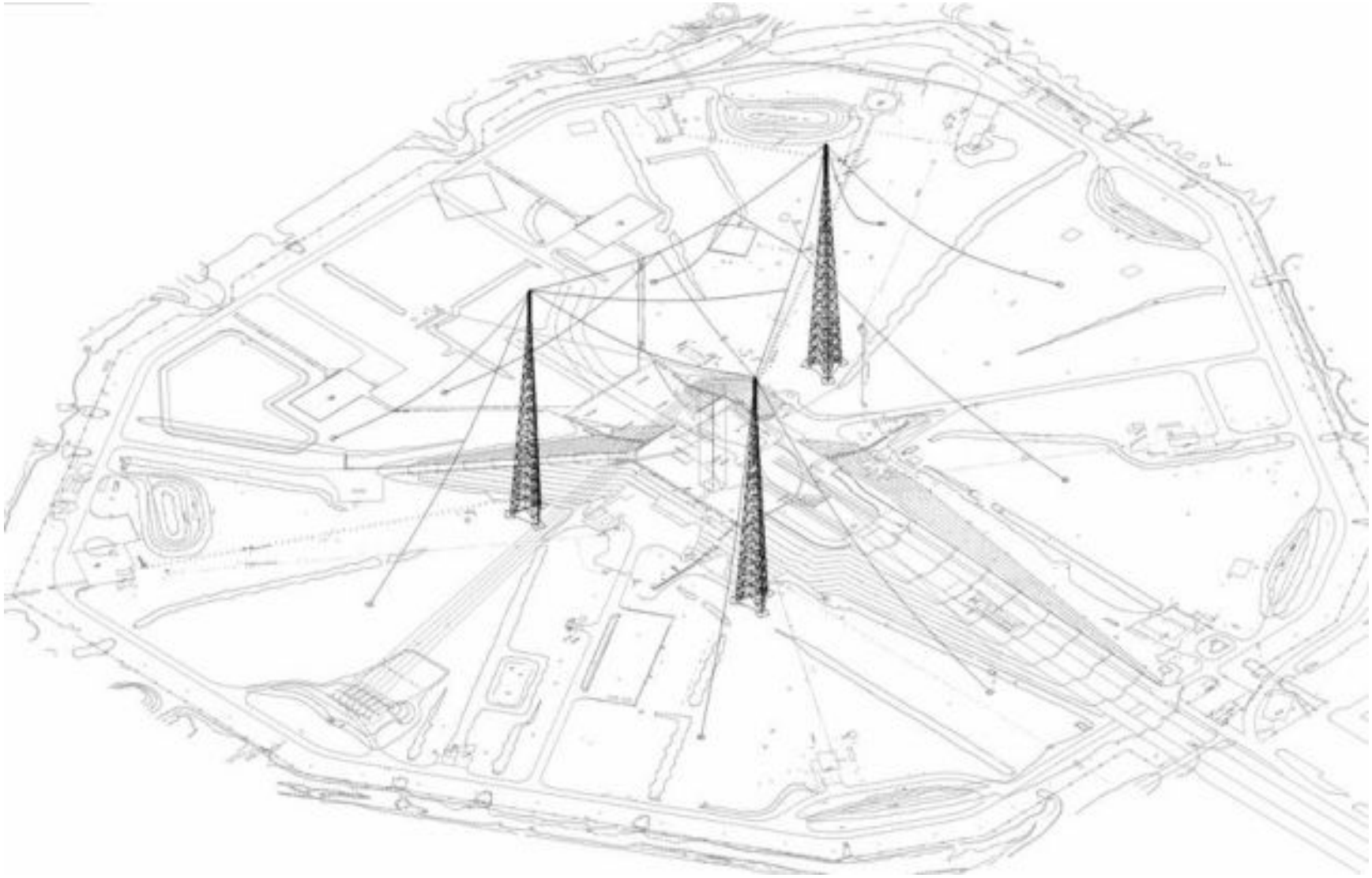

Figure 2-3. Proposed Lightning Protection System location within LC 39B, KSC, Florida.


Figure 2.4. Proposed Mobile Launcher, KSC, Florida.

Table 2-1. Monthly lightning strike data for Brevard County, Florida. (NOAA 2007).

| Month | Lightning Strikes |
|---|---|
| January | 37 |
| February | 81 |
| March | 288 |
| April | 576 |
| May | 838 |
| June | 4,398 |
| July | 5,707 |
| August | 6,676 |
| September | 2,461 |
| October | 1,100 |
| November | 31 |
| December | 3 |

# 3.0. Affected Environments

Chapter 3 describes the various environments and resources that could potentially be affected by the action alternatives evaluated in this EA. KSC encompasses nearly 56,000 hectares (ha) (140,000 ac.) on the east coast of central Florida (Figure 1-1). KSC is the launch site for NASA's Space Shuttle program and is the primary eastern U.S. Shuttle landing site. Approximately 2,500 ha (6,000 ac.) of KSC are actively used to support space mission operations; the remaining lands are managed by the U.S. Fish and Wildlife Service (USFWS) as the Merritt Island National Wildlife Refuge (MINWR). Immediately adjacent and north of KSC is the Canaveral National Seashore (CNS) which is managed by the National Park Service (NPS). This unique relationship between space flight and protection of natural resources is carefully orchestrated to ensure that both objectives are achieved with minimal conflict.

## 3.1 Facilities and Infrastructure

There are over 700 facilities located on KSC. Uses range from storage of toxic chemicals to launch support to offices.

### 3.1.1 Transportation

KSC is serviced by over 340 kilometers (km) [211 miles (mi.)] of roadways, with 263 km (163 mi.) of paved roads and 77 km (48 mi.) of unpaved roads. NASA Causeway is the primary entrance and exit for cargo, tourists, and personnel. This four-lane road originates on the mainland in Titusville as State Route (SR) 405 and crosses the Indian River Lagoon (IRL) onto KSC. Once passing through the Industrial Area, the road reduces to two lanes of traffic, crosses over the Banana River, and enters the CCAFS. The major north-south artery for KSC is Kennedy Parkway (SR 3). It can be accessed from the north where it intersects with US 1 south of Oak Hill, and from Titusville via SR 406/402. The southernmost entrance and exit for KSC is on SR 3 at north Merritt Island.

### 3.1.2 Wastewater Treatment

Approximately 80% of the sanitary sewer service at KSC is provided by two collection/transmission systems, one located in the Industrial Area and one in the VAB area. These systems collect and transport raw wastewater to the Regional Plant located on CCAFS. There are also a number of septic tank systems throughout KSC that typically support small offices or temporary facilities (NASA 2003).

### 3.1.3 Electricity and Natural Gas

The electric power distribution system at KSC is a combination of a Florida Power and Light Company (FPL) transmission system and two NASA-owned distribution systems. FPL transmits 115 kilovolts (kV) to KSC, which are distributed to two major substations. The C-5 substation serves the LC 39 Area, providing 13.8 kV, and the Orsino substation serves the Industrial Area, providing 13.2 kV, for a total of 25 % of the available electricity. From 2001 through 2006, electricity use on KSC ranged between 270,000 and 293,000 megawatt-hours; electricity consistently provides 71 % of KSC's total energy (SGS 2006).

In 1994, KSC began converting some facilities, equipment, and vehicles to natural gas. A 40 km (25 mi.) pipeline was constructed by City Gas Company of Florida, which distributes the gas within KSC. In 2006, 3.6 million therms of natural gas were used, accounting for approximately 28 % of KSC's total energy use (SGS 2006).

### 3.1.4 Communications

The KSC Communications System provides a variety of services including: 1) conventional telephone services; 2) transmission of voice data and video; 3) voice data and video services; and 4) operation and maintenance of KSC's cable plant. There are three major distribution and switching stations located in the Industrial Area (First Switch) and in the VAB Area (Second and Third Switches). These three stations provide service for over 18,500 telephones on KSC.

### 3.1.5 Potable Water

KSC's potable water is supplied by the City of Cocoa, which obtains its water from artesian wells located west of the St. Johns River in Orange County. Water enters KSC along SR 3 from a 60 centimeters (cm) [24 inch (in.)] water main and extends north along SR 3 to the VAB Area. The average demand for water is 3.8 million liters (l)/day [1 million gallons (gal.)/day] (NASA 2003). Total storage capacity at KSC is approximately 15 million l (4 million gal.) in ten above-ground storage tanks (NASA 2003).

## 3.2 Air Quality

The ambient air quality at KSC is predominantly influenced by daily operations such as vehicle traffic, utilities fuel combustion, and standard refurbishment and maintenance operations. Other operations occurring infrequently throughout the year, including launches and prescribed fires, also play a role in the quality of air at KSC as episodic events. Air quality is influenced to some extent by emissions sources outside of KSC, primarily two regional oil-fired power plants located within a 18.5 km (10 mi.) radius of KSC.

The ambient air quality is monitored by a Permanent Air Monitoring System (PAMS) station located north of the Industrial Area. The PAMS station continuously monitors concentrations of sulfur dioxide, nitrogen dioxide, carbon monoxide, and ozone, as well as meteorological data. KSC is currently located within an area classified as attainment with respect to the National Ambient Air Quality Standards established by the Environmental Protection Agency (EPA) and Florida Department of Environmental Protection for all criteria pollutants (NASA 2003).

Total inhalable 10-micron particulates (PM-10) were monitored historically (1983 – 1989, 1992 – 1999) at the PAMS and two other sites on KSC. During those times, there was only one exceedance in PM-10; this occurred during the ground clearing for the ISS (Drese 2006).

### 3.2.1 Meteorology

The climate at KSC is characterized as maritime-tropical with humid summers and mild winters. The area experiences moderate seasonal and daily temperature variations. Average annual temperature is 22° centigrade (C) [71° Fahrenheit (F)] with a minimum monthly average of 13° C (60° F) in January and a maximum of 28° C (81° F) in July. During the summer, the average daily humidity range is 70 to 90 %. The winter is drier with humidity ranges of 55 to 65 % (Mailander 1990).

Prevailing winds during the winter are steered by the jet stream aloft and are typically from the north and west. As the jet stream retreats northward during the spring, the prevailing winds shift and come from the south. During the summer and early fall, as the land-sea temperature difference increases and the Bermuda high-pressure region strengthens, the winds originate predominantly from the south and east.

The central Florida region has the highest number of thunderstorms in the U.S. during the summer months (May – September), and over 70 % of the annual 122 cm (48 in.) of rain occurs in the summer. During thunderstorms, wind gusts of more than 97 kilometers/hour (60 mi./hr.) and rainfall of over 2.5 cm (1.0 in.) often occur in a one-hour period, and there are numerous cloud-to-ground lightning strikes. Hurricanes can also develop, typically between August and October. The most active hurricane season in KSC's history was 2004, when damages to facilities exceeded $100 million. Additionally, many habitats, such as marshes, shoreline, and dunes were affected, at least temporarily, due to the storm surge and beach erosion (NASA 2004b).

## 3.3 Biological Resources

Biological resources include vegetation, wildlife, and the habitats in which they live. Protected species and the overall biodiversity of an area are also considered in this section. The habitats found on KSC and the adjacent federal properties provide for the greatest wildlife diversity among Federal facilities in the continental U.S. (Breininger et al. 1994). This diversity can be attributed to several factors. KSC is located within a biogeographical transition zone, having faunal and floral assemblages derived from both temperate Carolinian and tropical/subtropical Caribbean biotic provinces (Ehrhart 1976, Sweet et al. 1979, Greller 1980, Stout 1979, DeFreese 1991). The area is encompassed within the IRL watershed, considered to be the most diverse estuarine system in North America (The Nature Conservancy 2007). KSC is bordered on the west by the IRL, on the southeast by the Banana River, and on the north by the Mosquito Lagoon. Further to the west of KSC lies the St. Johns River Basin ecosystem, one of the largest freshwater marsh systems in the state. In addition, KSC's proximity to the coast encourages an abundance of migratory birds. All of these factors combined contribute to the exceptional species diversity found here (Breininger et al. 1994).

### 3.3.1 Habitats and Vegetation

Florida's geological history has largely been determined by sea level changes that directly influenced soil formation and topography, and resulted in the plant communities present today. A "ridge and swale" topography is present on KSC where there are adjacent bands of uplands and wetlands running in a generally north/south direction across the island. The dominant uplands communities are scrub and pine flatwoods (Provancha et al. 1986). Long, narrow freshwater marshes are interspersed among the bands of uplands. Forests occur on higher areas among marshes and lower areas among scrub and pine flatwoods (Breininger et al. 1994). Adjacent to the estuary that surrounds much of KSC are salt marshes, various wetland shrub habitats, and mangrove swamps. A detailed list of habitat types and acreages found on KSC is in Appendix 2.

### 3.3.2 Wildlife

#### 3.3.2.1 Invertebrates and Fish

The IRL was designated as an "estuary of national significance" in 1990 by the EPA. The IRL supports over 400 species of fishes (Gilmore 1977, Snelson 1983), 260 species of mollusks, and 479 species of shrimps and crabs (Woodward-Clyde 1994). Commercially important species include game fish (e.g., snook, *Centropomus undecimalis*, seatrout, *Cynoscion nebulosus*, and tarpon, *Megalops atlanticus*) and crabs. In addition, several areas of the IRL are important shellfish harvesting areas. Lagoon habitats serve as nursery grounds for virtually all fish resident within the lagoon, as well as many

offshore species. Studies of terrestrial invertebrates have been limited to research aimed at controlling salt marsh mosquitoes *Ochlerotatus taeniorrhynchus* and *Ochlerotatus sollicitans* (Platts et al. 1943, Clements and Rogers 1964). A detailed biological survey of terrestrial invertebrates has not been performed on KSC.

### 3.3.2.2 Herpetofauna

Fifty species of reptiles and 19 species of amphibians have been documented as occurring on KSC (Seigel et al. 2002). Six of these species are federally protected as Threatened (T) and Endangered (E) and will be further discussed in Section 3.4.1, including three species of sea turtles that nest along the coastline during the summer months, and use the surrounding lagoons as developmental habitat for juveniles.

Three species of the 69 documented are not federally listed, but are protected by the State of Florida. These include the Florida gopher frog (*Rana capito aesopus*), the gopher tortoise (*Gopherus polyphemus*), and the Florida pine snake (*Pituophis melanoleucus mugitis*). The Florida gopher frog and Florida pine snake are uncommon on KSC and little is known about their numbers or distribution. Conversely, the gopher tortoise is common, wide-spread, and well studied on KSC. The gopher tortoise inhabits the uplands where it excavates burrows for shelter from weather, climate, predators and fire. Many other vertebrate and invertebrate species also use the tortoise burrows, and for this reason, the tortoise is considered a keystone species. Because gopher tortoises prefer the uplands habitats that are typically used for development, and are often found in previously disturbed areas, conflicts with operations occasionally arise. The KSC Gopher Tortoise Policy is to 1) avoid disturbing gopher tortoises or their burrows whenever possible by working with project managers to reconfigure projects; 2) to remove tortoises from harm's way when temporary impacts cannot be avoided so they can remain or be returned to their original home range once the project is completed; or 3) to relocate away from the project site if the impacts are widespread and permanent.

### 3.3.2.3 Birds

KSC provides habitat for 330 bird species (USGS 2007); nearly 90 species nest on KSC, many of which are year-round residents. There are over 100 species that reside in the area during the winter. The remaining species regularly use KSC lands and waters for brief periods of time, usually during migration. KSC lies within the Atlantic flyway, a major migratory bird corridor that extends from the Artic coast of Alaska to the mainland of South America. Millions of songbirds, seabirds, birds of prey, and waterfowl follow the Atlantic flyway every fall and spring.

Four species of birds that occur on KSC are federally protected and discussed further in Section 3.4. In addition, there are 11 species that are protected by the State of Florida (Table 3-1). Six of these belong to a group of birds commonly called waders (Order Ciconiiformes). Monthly surveys of wading bird feeding habitats have been flown since 1987, and surveys of nesting colonies are also done during the spring (Figure 3-1). The wading bird population on KSC is very large; it is estimated that between 5,000 and 15,000 birds are present at any given time, depending on the season (Smith and Breininger 1995). The largest numbers occur during the spring and the fewest birds are present in the winter.

Of the remaining five State-listed bird species, two are common year-round residents (eastern brown pelican, *Pelecanus occidentalis carolinensis,* and black skimmer, *Rynchops niger*), the least tern (*Sterna antillarum*) is common, but leaves in the winter, and the

remaining two species are common in the winter (Arctic peregrine falcon, *Falco peregrinus tundrius,* and Southeastern American kestrel, *Falco sparverius paulus).*

#### 3.3.2.4 Mammals

Thirty species of mammals inhabit KSC lands and waters (Ehrhart 1976). Typical terrestrial species include the opossum (*Didelphis virginiana*), hispid cotton rat (*Sigmodon hispidus*), raccoon (*Procyon lotor*), river otter (*Lutra canadensis*), and bobcat (*Lynx rufus*). Due to the regional loss of large carnivores such as the Florida panther (*Puma concolor coryi*) and red wolf (*Canis rufus*), the bobcat and otter now hold the position of top mammalian predators on KSC. Additionally, a proliferation of mid-level predators such as the raccoon and opossum has resulted from an imbalance of predator/prey ratios. Opportunistic species such as the cotton rat and eastern cottontail rabbit (*Sylvilagus floridanus*) account for a large portion of the small mammal biomass, rather than habitat-specific species such as the State-listed Florida mouse (*Podomys floridanus*) and the federally protected southeastern beach mouse (*Peromyscus polionotus niveiventris*). At least three species of bats have been documented. They occasionally use facilities as roosts sites, and when conflicts occur, they must be excluded. Several bat houses have been erected on KSC to help mitigate the impacts. A very large, reproductively active bat roost is located in the bridge on SR 3 where it crosses over SR 405, just inside the KSC security gate. Several thousand bats are thought to use this bridge year-round. Two mammal species common in the waters of the IRL are the Atlantic bottlenosed dolphin (*Tursiops truncatus*) and the West Indian manatee (*Trichechus manatus*).

## 3.4 Threatened and Endangered Species

### 3.4.1 Listed Wildlife

Seventeen federally listed wildlife species have been documented on KSC/MINWR, more than on any other national wildlife refuge in the continental U.S. Six of these are only incidentally present and do not make important contributions to the area's biota: hawksbill sea turtle (*Eretmochelys imbricata*), Kemp's ridley sea turtle (*Lepidochelys kempi*), snail kite (*Rosthrhramus sociabilis*), Audubon's crested caracara (*Polyborus plancus audubonii*), piping plover (*Charadrius melodus*), and roseate tern (*Sterna dougallii*). The American alligator (*Alligator mississippiensis*) was once on the brink of extinction, but recovery efforts enabled populations throughout its range to rebound strongly. They are abundant on KSC and can sometimes cause problems related to traffic safety and encounters with people around and within facilities. However, because the alligator is similar in appearance to another listed species, the American crocodile (*Crocodylus acutus*), it remains on the federally protected list.

Ten federally listed species occur on KSC either commonly or occasionally: loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), leatherback sea turtle (*Dermochelys coriacea*), eastern indigo snake (*Drymarchon couperi*), Atlantic salt marsh snake (*Nerodia clarkii taeniata*), wood stork (*Mycteria americana*), bald eagle (*Haliaeetus leucocephalus*), Florida scrub-jay (*Aphelocoma coerulescens*), southeastern beach mouse (*Peromyscus polionotus niveiventris*), and the West Indian manatee (*Trichechus manatus*).

#### *Sea Turtles*

Three different sea turtle species nest along KSC, CCAFS, and CNS beaches between March and September. These turtles include the loggerhead (T), green sea turtle (E), and leatherback sea turtle (E). Nesting sea turtle

research has taken place on these beaches since the early 1970s, and long-term monitoring has been done for KSC's Life Science Services contract since 1984. The loggerhead accounts for over 95% of the nests on KSC, with an annual average of 1,300 (Popotnik and Epstein 2002). Green sea turtle nest numbers oscillate between 50 nests one year and 200 nests the next. Leatherback sea turtles nest infrequently on KSC, with only one or two nests recorded in a typical year. Management for these species differs among the three beaches (i.e., agencies), but includes yearly monitoring of numbers of nests and false crawls, dune restoration when appropriate, and predator control. Primary nest predators include raccoons, feral hogs (*Sus scrofa*), and ghost crabs (*Ocypode quadrata*). Lighting disorientation impacts from KSC and CCAFS facilities are a concern for nesting and hatchling sea turtles. USFWS Endangered Species permits have been obtained and impacts are closely monitored. Coordinated efforts between the USFWS, KSC, and CCAFS help to reduce and/or eliminate adverse effects of lighting on sea turtle nesting and hatchling disorientation (NASA 2002c).

The IRL surrounding KSC provides developmental habitat for juvenile sea turtles (Mendonca and Ehrhart 1982), with the majority being found in Mosquito Lagoon. Species observed include the loggerhead, green sea turtle and recently, a Kemps Ridley (*Lepidochelys kempii*). Data collected over many years through 2006 have the following general findings: During the 1990s to present, green turtles occur at much higher frequencies than loggerheads, exactly opposite of results from the mid-1970s. The relative numbers of turtles are much lower in Mosquito Lagoon as compared to further south in the IRL. The incidence of the fibropapilloma virus in this area is no different than other sections of the IRL. The animals using Mosquito Lagoon tend to reside there for at least several years prior to departure, based on capture sizes and recapture information (Provancha et al. 2005). The Mosquito Lagoon provides vast seagrass beds for green turtles to forage and shellfish resources are available for loggerheads. This Mosquito Lagoon study area has been recommended as a long-term index study site by the State of Florida (Eaton et al. 2006).

### *Eastern Indigo Snake*

Eastern indigo snakes became federally listed as threatened under the Endangered Species Act in 1978. They are thought to be common on KSC, although actual population numbers would be quite difficult to obtain. Eastern indigo snakes have very large home ranges and use a variety of habitat types that include uplands, wetlands, hammocks, and disturbed areas. Research on home range sizes, habitat use, and trapping methods using radio tagged indigos has been conducted on KSC beginning in the early 1990s (Breininger et al. 2004; Dyer 2004).

### *Bald Eagle*

KSC supports an annual average of 14 breeding pairs of the federally threatened Southern bald eagle; see Figure 3-2 for 2005/2006 nest sites. Production for the 2004 – 2006 seasons averaged between eight and 14 fledglings (Bolt and Cancro 2006). Eagles use mature live pines and pine snags within the pine flatwoods habitats. They also will occasionally build nests on man-made towers. KSC offers an ideal situation for bald eagle nesting due to the wide expanse of relatively undisturbed pine flatwoods, and the freshwater and estuarine wetland complex that provides a diversity of excellent foraging habitats (Hardesty and Collopy 1991).

### *Florida Scrub-jay*

The federally threatened Florida scrub-jay is found in Florida and nowhere else in the world. Habitats occupied by Florida scrub-jays are typically oak scrub, oak/palmetto, and

coastal scrub, as well as ruderal and disturbed areas in coastal regions. In order for scrub-jays to persist and flourish, the characteristics of the habitat must fall within a narrow range that is ideally maintained by fire. Florida scrub-jays live year-round in fairly stable territories, mate for life, and the young stay in their natal territory with the family for several years.

KSC and CCAFS together support one of the largest remaining populations of Florida scrub-jays, with an estimate of 850 pairs (USFWS 2007). Scrub-jay habitat is intensively managed on KSC, primarily by controlled burning and mechanical treatment. KSC has a scrub habitat compensation plan that is used to determine mitigation rates when scrub is taken for development (Schmalzer et al. 1994). Mitigation takes place as restoration of degraded scrub habitat elsewhere on KSC. Scrub-jay and scrub habitat research began on KSC in the late 1970s, and over 40 articles have been published in scientific journals or as Master's theses.

#### *Wood Stork*

Wood storks are federally protected as endangered. Wood stork populations have declined sharply in Florida, from 60,000 pairs in the 1930s to 11,232 pairs in 2006. Monthly aerial wading bird surveys show that approximately 250 wood storks use KSC impoundments, ditches, and estuaries for feeding and roosting. Wood storks are present on KSC throughout the year, but there is an apparent influx of non-resident birds during the winter.

#### *Southeastern Beach Mouse*

The federally threatened southeastern beach mouse is a subspecies of the old field mouse (*P. polionotus*). It inhabits the sand dunes and adjoining scrub along the Atlantic coastline. Extensive coastal development has resulted in the loss and fragmentation of coastal dunes habitat for all of the subspecies of beach mice in Florida. The historic range of the southeastern beach mouse once extended from Ponce Inlet to Miami Beach. Currently, it can only be found from Apollo Beach to Port Canaveral, with isolated small populations at Archie Carr National Wildlife Refuge and Sebastian Inlet State Park. KSC provides habitat and protection for the last remaining core populations of this subspecies. Population monitoring and habitat use evaluations have occurred sporadically since the early 1980s.

#### *West Indian Manatee*

The estuarine waters surrounding KSC serve as a year-round safe harbor and foraging areas for West Indian manatees. Monthly aerial surveys of manatees have been conducted over the Banana River since 1977. Manatees can be found at KSC during all months of the year except when winter cold fronts drop water temperatures below 19 C (66 F). KSC generally experiences a spring peak in manatees followed by a fairly consistent number of animals in summer, another increase each fall, and then a drop each winter. The north end of the Banana River, south to near KARS Park I, is protected from entry of motorized watercraft, either by KSC security restrictions or as a designated manatee sanctuary. In 2003, peak counts resulted in over 670 individuals observed on one survey. This represents approximately 20% of the total Florida population and perhaps 40% of the east coast population. It is assumed that the quiet KSC waters (within the sanctuary) combined with extensive seagrass beds (primarily *Halodule* and *Syringodium)* provide good habitat that manatees continue to use and teach their offspring to locate (Provancha and Hall 1991).

### 3.4.2 Listed Plants

No federally listed plant species have been found to occur on KSC. KSC supports 33

plant species that are protected by the State of Florida, either as threatened, endangered, or commercially exploited (NASA 2002b, Schmalzer and Foster 2005).

## 3.5 Cultural Resources

The proposed modifications to existing facilities and construction of new facilities would involve one listed Historic Property in one Historic District on KSC, 8BR2010 Launch Complex 39B. This facility was originally designated as a Historic Property in the mid-1970s, based on its association with the Apollo program. It was reevaluated in the 1990s and the nomination was modified to establish the area within the LC 39B perimeter as a Historic District. Specific elements were identified as eligible for listing on the National Register of Historic Places, including the launch pad, associated towers, and various other elements. This property was resurveyed in 2006 for eligibility as related to the Space Shuttle program, and it is anticipated that the nomination will be modified to include this information.

## 3.6 Geology and Soils

### 3.6.1 Geology

The following information was taken from "Geology, Geohydrology and Soils of Kennedy Space Center: A Review" (Schmalzer and Hinkle 1990).

Sediments underlying KSC have accumulated in alternating periods of deposition and erosion since the Eocene. Surface sediments are of Pleistocene and Recent ages. Fluctuating sea levels with the alternating glacial interglacial cycles have shaped the formation of the barrier islands. Merritt Island is an older landscape whose formation may have begun as much as 240,000 years ago, although most of the surface sediments are not that old. Cape Canaveral probably dates from <7,000 years before present, as does the barrier strip separating Mosquito Lagoon from the Atlantic Ocean. Deep aquifers beneath KSC are recharged inland but are highly mineralized in the coastal region and interact little with surface vegetation. The Surficial aquifer is recharged by local rainfall. Sand ridges in the center of Merritt Island are important to its recharge. Discharge is from evapotranspiration, seepage to canals and ditches, seepage into interior wetland swales, and seepage into impoundments, lagoons, and the ocean. This aquifer exists in dynamic equilibrium with rainfall and with the fresh-saline water interface. Freshwater wetlands depend on the integrity of this aquifer, and it provides freshwater discharge to the lagoons and impoundments.

### 3.6.2 Soils

The soils of KSC are mapped in the soil surveys for Brevard County (Huckle et al. 1974) and Volusia County (Baldwin et al. 1980). Fifty-eight soil series and land types are represented, even though Merritt Island is a relatively young landscape and one formed from coastal plain deposits. The primary source of parent material for KSC soils is sands of mixed terrestrial and biogenic origin. The terrestrial material originated from southern rivers carrying sediments eroded from highly weathered Coastal Plain and Piedmont soils; these sediments are quartzose with low feldspar content (Milliman 1972). These sediments moved south through long-shore transport and may have been reworked repeatedly. The biogenic carbonate fraction of the sand is primarily of mollusk or barnacle origin with lesser contributions of coralline algae and lithoclasts; some may be reworked from offshore deposits of coquina and oolitic limestone (Milliman 1972). Soils on CCAFS and the barrier island section east of Mosquito Lagoon are younger than those of Merritt Island and, therefore, have had less time to

weather. Well-drained soil series (e.g., Palm Beach and Canaveral) in these areas still retain shell fragments in the upper layers, while those inland on Merritt Island (e.g., Paola and Pomello) do not. The presence of shell fragments influences soil nutrient levels, particularly calcium and magnesium, and pH. The eastern and western sections of Merritt Island also differ in age. The eastern section of Merritt Island inland to about SR 3 has a marked ridge-swale topography, presumably retained from its formation as a barrier island; west of SR 3, the island is flatter, without obvious ridges and swales, probably due to the greater age of this topography. Differences in age and parent material account for some soil differences, but on landscapes of Merritt Island with similar age, topography has a dramatic effect on soil formation. Relatively small elevation changes cause dramatic differences in the position of the water table that, in turn, affect leaching, accumulation of organic matter, and formation of soil horizons. In addition, proximity to the lagoon systems influences soil salinity (NASA 2003).

## 3.7 Noise

Noise generated at KSC originates from six different sources: 1) launches, 2) Space Shuttle reentry sonic booms, 3) aircraft, 4) industrial operations, 5) construction, and 6) traffic. Noise generated above ambient levels by these sources has the potential to adversely affect both wildlife and humans. Some typical values for noise levels from construction and vehicles are shown in Appendix 3. Some research on the effects of noise on wildlife has been conducted at KSC during the launch of spacecraft. These studies have shown that besides an initial startle response to launches, birds and other wildlife return to their normal activities soon afterward, and show no immediate adverse effects. Other studies conducted on wading bird colonies subjected to military overflights at 152 m (500 ft.) altitude with noise levels up to 100 decibels (weighted to the A-scale) documented no productivity limiting responses and only a short-term interruption of the birds' normal routine. Permissible noise exposure limits for humans are established by the Occupational Safety and Health Administration (OSHA). The 8-hour time weighted average noise level on KSC is appreciably lower than the OSHA recommended level of 85 decibels, A-weighted (dBA) (OSHA 2006).

## 3.8 Surface Water Quality

The surface waters in and surrounding KSC are shallow estuarine lagoons and include portions of the Indian River, the Banana River, Mosquito Lagoon, and Banana Creek. The area of Mosquito Lagoon within the KSC boundary and the northernmost portion of the IRL, north of the Jay Jay Railway spur crossing (north of SR 406), are designated by the State as Class II, Shellfish Propagation and Harvesting. All other surface waters at KSC have been designated as Class III, Recreation and Fish and Wildlife Propagation. All surface waters within MINWR are designated as Outstanding Florida Waters as required by Florida Statutes for waters within national wildlife refuges.

NASA, the USFWS, and Brevard County maintain water quality monitoring stations at surface water sites within and around KSC. The data collected are used for long-term trend analysis to support land use planning and resource management. Surface water quality at KSC is generally good, with the best water quality being found adjacent to undeveloped areas of the IRL, such as Mosquito Lagoon, and the northernmost portions of the Indian River and Banana River (NASA 2003).

## 3.9 Groundwater Quality

The State of Florida has created four categories used to rate the quality of groundwater in a particular area. The criteria for these categories are based on the degree of protection that should be afforded to that groundwater source, with Class G-I being the most stringent and Class G-IV being the least. The groundwater at KSC is classified as Class G-II, which means that it is a potential potable water source and generally has a total dissolved solids content of less than 10,000 milligrams/liter (parts per million) (NASA 2003). The subsurface of KSC is comprised of the Surficial Aquifer, the Intermediate Aquifer, and the Floridan Aquifer. Recharge to the Surficial Aquifer system is primarily due to the infiltration of precipitation; however, the quality of water in the aquifer beneath KSC is influenced by the intrusion of saline and brackish surface waters from the Atlantic Ocean and the IRL. This is evident by the high mineral content, principally chlorides, that has been measured in groundwater samples collected during various KSC surveys.

## 3.10 Socioeconomics

KSC is Brevard County's largest single employer and a major source of revenue for the local economy. KSC operations create a chain of economic effects throughout the region. Each job created within Brevard County's space industry is estimated to generate an additional 1.93 jobs within the region (NASA 2003). Other large employers in the county are Patrick Air Force Base, the Brevard County School District, and Health First. Approximately 15,200 personnel were employed at KSC in 2003, a number that includes contractor, construction, tenant, and permanent civil service employees. On KSC, civil service employees account for approximately 12 % of the total workforce. The highest employment levels at KSC were recorded during the Apollo program. In 1968, KSC recorded a peak population of 25,895, with an estimated one in four workers in Brevard County employed at KSC. Employment levels dropped precipitously following the Apollo program to a historic low in 1976, when a total of 8,441 personnel were employed. Employment levels rose sharply in 1979 when KSC was designated as the launch and operations support center for the Space Shuttle program.

Approximately 50 % of the 15,200 people at KSC have positions directly related to the Shuttle and payload processing operations. The remaining workforce is employed in ground and base support, unmanned launch programs, crew training, engineering, and administrative positions. The largest concentration of personnel is stationed in the LC 39 Area, and the next largest concentration is in the Industrial Area. Remaining personnel are stationed at various outlying facilities.

## 3.11 Land Use

Land and open water resources of KSC comprise 56,500 ha (139,490 ac.) in Brevard and Volusia Counties, and are located along the east coast of central Florida at $28^{o}$ 38'N, $80^{o}$ 42'W (NASA 2003). The majority of the land areas comprising KSC are on the northern part of Merritt Island, which forms a barrier island complex with adjacent Cape Canaveral (NASA 1979). Undeveloped areas, including uplands, wetlands, mosquito control impoundments, and open water areas, comprise approximately 95 % of the total KSC area (NASA 2003). Nearly 40 % of KSC consists of open water, including portions of the Indian River, Banana River, Mosquito Lagoon, and all of Banana Creek (NASA 2003).

KSC was established under NASA jurisdiction for the purpose of implementing the Nation's space program (NASA 2003). NASA

maintains operational control over approximately 1,806 ha [4,463 acres (ac)] of KSC. This area comprises the functional area, which is dedicated to NASA operations (NASA 2003). Undeveloped operational areas are dedicated safety zones around existing facilities or are reserved for planned and future expansion.

The overall land use and management objectives of NASA and KSC are to maintain the Nation's space mission operations while supporting alternative land uses that are in the Nation's "best interest" under the Space Act (NASA 2003). Towards these ends, KSC developed a Land Use Plan in 1999 and then participated in the development of the Cape Canaveral Spaceport Master Plan, in cooperation with the 45th Space Wing and the Florida Space Authority. These plans provide an overall context for future land uses on KSC while not identifying any specific facility or land development projects. Such future projects will be driven by program changes and management decisions as yet undefined.

The designation of MINWR and CNS, in 1963 and 1975 respectively, on the 54,851 ha (135,537 ac) outside of NASA's operational control reflects this "best interest" objective. Both MINWR and CNS effectively provide a buffer zone between NASA operations and the surrounding communities (Figure 1-1). NASA delegated land management responsibilities for MINWR to the USFWS and for CNS to the NPS. The USFWS and NPS exercise management control over agricultural, recreational, and environmental programs within their respective jurisdictions (NASA 2003). NASA remains the landowner and maintains the option to remove lands from the MINWR or CNS as needed to support the space program (NASA 2003). NASA, working in partnership with the USFWS and NPS, has demonstrated that through careful land planning and management, the requirements of space flight and protection of natural resources can be achieved with minimal conflict (NASA 2003).

Table 3-1: Threatened and endangered wildlife species documented from KSC, Florida.

| SCIENTIFIC NAME | COMMON NAME | LEVEL OF PROTECTION | |
|---|---|---|---|
| **Amphibians and Reptiles** | | **STATE** | **FEDERAL** |
| *Rana capito aesopus* | Florida gopher frog | SSC | - |
| *Alligator mississippiensis* | American alligator | SSC | T(S/A) |
| *Caretta caretta* | Loggerhead | T | T |
| *Chelonia mydas* | Atlantic green turtle | E | E |
| *Dermochelys coriacea* | Leatherback sea turtle | E | E |
| *Gopherus polyphemus* | Gopher tortoise | SSC | - |
| *Drymarchon couperi* | Eastern indigo snake | T | T |
| *Nerodia clarkii taeniata* | Atlantic saltmarsh snake | T | T |
| *Pituophis melanoleucus mugitus* | Florida pine snake | SSC | - |
| **Birds** | | | |
| *Pelecanus occidentalis carolinensis* | Eastern brown pelican | SSC | - |
| *Egretta thula* | Snowy egret | SSC | - |
| *Egretta caerulea* | Little blue heron | SSC | - |
| *Egretta tricolor* | Tricolored heron | SSC | - |
| *Egretta rufescens* | Reddish egret | SSC | - |
| *Eudocimus albus* | White ibis | SSC | - |
| *Ajaia ajaja* | Roseate spoonbill | SSC | - |
| *Mycteria americana* | Wood stork | E | E |
| *Haliaeetus leucocephalus* | Bald eagle | T | T |
| *Falco peregrinus tundrius* | Arctic peregrine falcon | E | - |
| *Falco sparverius paulus* | Southeastern American kestrel | T | - |
| *Charadrius melodus* | Piping plover | T | T |
| *Sterna antillarum* | Least tern | T | - |
| *Rynchops niger* | Black skimmer | SSC | - |
| *Aphelocoma coerulescens* | Florida scrub-jay | T | T |
| **Mammals** | | | |
| *Peromyscus polionotus niveiventris* | Southeastern beach mouse | T | T |
| *Podomys floridanus* | Florida mouse | SSC | - |
| *Trichechus manatus* | West Indian manatee | E | E |

Key: E = endangered, SSC = species of special concern, T = threatened, T(S/A) = threatened due to similarity of appearance

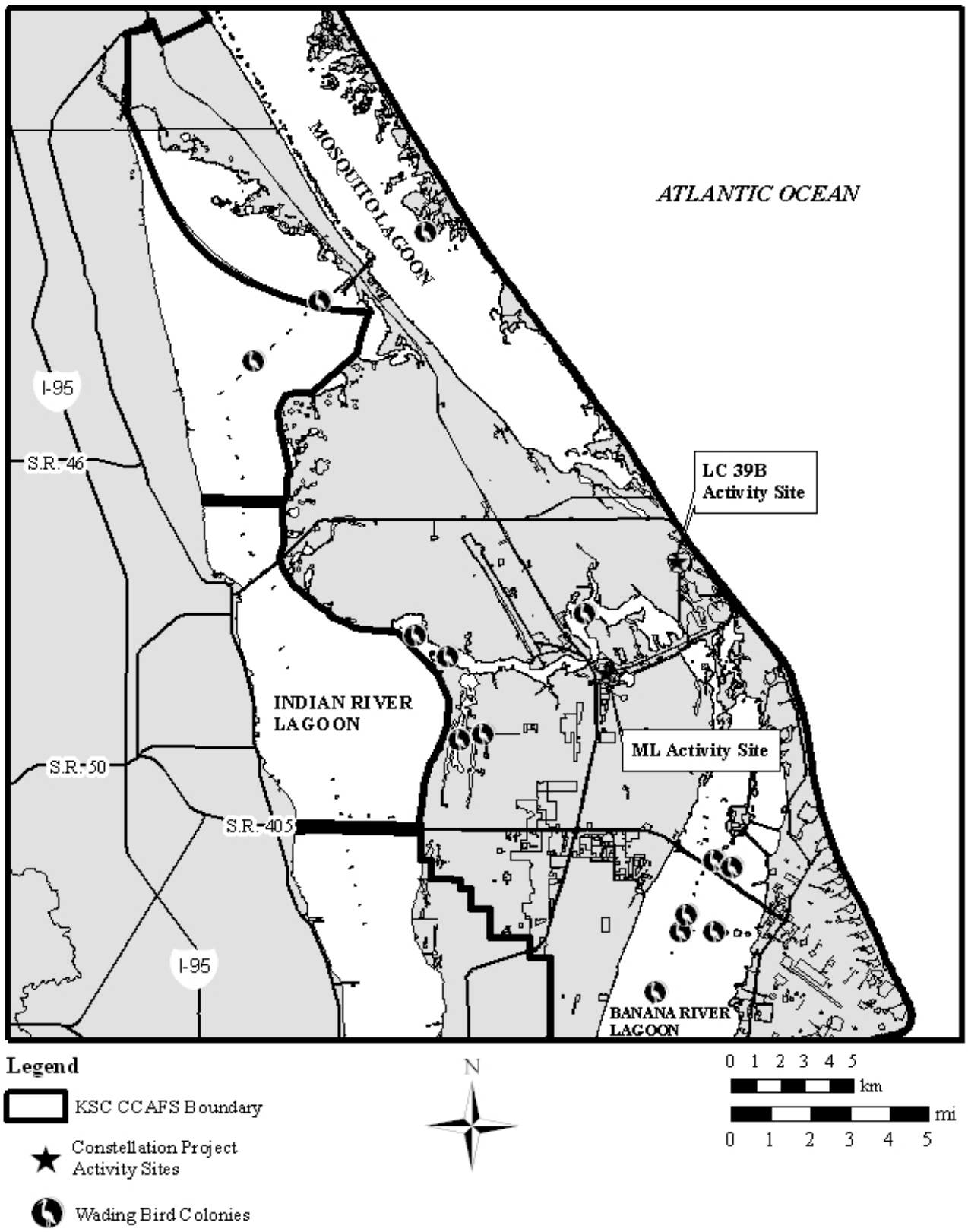


Figure 3-1. Wading bird nesting colonies active on KSC, Florida, 2004 - 2006.

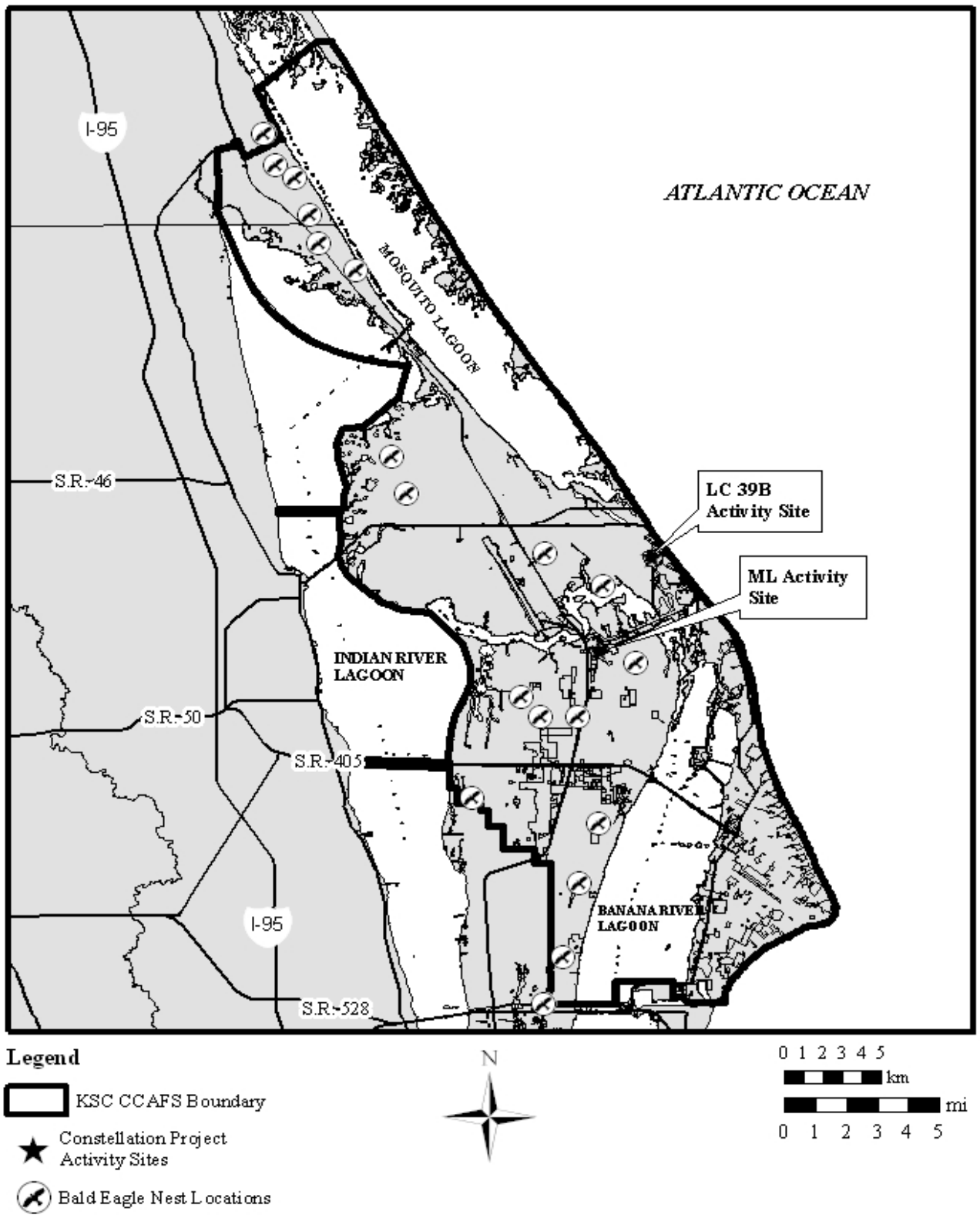


Figure 3-2. Bald eagle nest sites (active and inactive) on KSC, Florida, 2006.

# 4.0. Environmental Consequences

Chapter 4 summarizes the potential impacts that the two alternative actions, No Action and Proposed Action, could have on environmental resources at KSC. It was determined that two resource categories, 1) Facilities and Infrastructure, and 2) Land Use, would not be impacted by either the No Action or Proposed Action alternatives; these were eliminated from further analysis. Facilities and Infrastructure would not be affected because no increased use of transportation or utilities resources would result from construction or operation of the three activities. Changes in land use resources are not planned and no impacts are expected. These categories are not addressed further in this chapter.

## 4.1 Summary and Status of Impacts

Potential impacts to resources resulting from the implementation of the two alternatives were identified and placed into one of the following pre-determined classifications:

- None – no impacts expected
- Minimal - impacts are not expected to be measurable, or are too small to cause any discernable degradation to the environment
- Minor - impacts would be measurable, but not substantial, because the impacted system is capable of absorbing the change, or mitigation measures compensate for potential degradation
- Major - impacts could individually or cumulatively be substantial

### 4.1.1 No Action Alternative

Under the No Action alternative, the early development, modification, and operation of facilities to support the Constellation Program would not occur at KSC. Facilities and launch-support infrastructure currently being utilized by the Space Shuttle program would become obsolete. Thousands of square feet of laboratories, office space, high-bays, and other areas would be abandoned in place or demolished. Socioeconomics would be the only resource affected by the No Action alternative. The Space Shuttle Program employs thousands of civil servants and contractor personnel, and a large reduction in the current work force would take place. This would have local as well as regional consequences by increasing unemployment and reducing the economic benefits associated with the loss of a skilled labor pool. These impacts could potentially be major (Table 4-1).

### 4.1.2 Proposed Action Alternative

Impacts of construction (including modifications of existing facilities) and operation of each of the activities included in the Proposed Action alternative vary from none to minor (Table 4-1). A discussion of these impacts follows in Section 4.2.

## 4.2 Analysis of Impacts from the Proposed Action Alternative

### 4.2.1 Air Quality

Construction - The site preparation and construction from the activities within the Proposed Action alternative would produce minimal impacts to the surrounding air quality. The clearing of land and other construction would generate airborne particulates from earth moving, as well as hydrocarbon exhaust from heavy equipment and generators. Such impacts are expected to

be small in scope and of short duration. Best Management Practices would be employed to mitigate for emissions due to earth movement, which would include water spraying for dust control.

Operation - Operations from the Proposed Action alternative are expected to have impacts to the surrounding air quality from operational fugitive emissions, transfer and storage of hypergols, and the possibility of the combustion emission from backup generators. Due to the incidental releases during fueling and storage operations and infrequent use of generators, the air emission impacts would be minimal.

## 4.2.2 Biological Resources

### 4.2.2.1 Habitats and Vegetation

None of the activities within the Proposed Action alternative are expected to impact any habitats or vegetation during construction or operation. No currently undeveloped land would be taken, and none would be affected by normal operation of any of the activities (Figures 4-1 a & b).

### 4.2.2.2 Wildlife

Construction – During the time that the ML is being erected at the Park Site, the 122 m (400 ft.) tall tower would be required to have FAA-approved lighting. Towers pose a collision risk to migratory birds that typically travel in large flocks at night. Tower lights are known to confuse birds, which increases the likelihood of bird strikes. The mitigation strategies discussed in Chapter 5 are expected to reduce these impacts to minor.

Because of the accelerated schedule prompted by the use of LC 39B for a potential Hubble Telescope rescue mission, some construction activities at LC 39B could occur at night. This would necessitate keeping the pad well lit after dark. Also, the FAA would require lighting on partially completed structures, as well as the large cranes that would be used. As with the ML construction, towers and tower lighting pose risks to night-flying birds, but these effects are expected to be minor based on the mitigation strategies in proposed in Chapter 5 of this EA. Increased lighting also increases the opportunity for adult and hatchling sea turtle disorientation. These impacts are discussed in Section 4.2.3 (Threatened and Endangered Species); mitigation and monitoring strategies are discussed in Chapter 5.

Operation – No impacts to wildlife are expected from operation of the ML or from the LC 39B tower modifications.

Potential impacts from operation of the LPS fall into three categories: 1) nighttime bird and bat strike risks due to tall, lit structures and wires, 2) daytime bird strike risks from low-visibility structures and wires, and 3) sea turtle disorientation risks due to increased lighting. Impacts 2 and 3 potentially affect protected species and are discussed further in Section 4.2.3 (Threatened and Endangered Species).

Impact 1 involves migratory birds traveling in large flocks at night, most of which are not listed as threatened or endangered, but are protected under the Migratory Bird Treaty Act. It is estimated that between four million and 50 million birds are killed each year in the U.S. by towers (Manville 2005). More precise estimates are not available because the preponderance of towers across the landscape is a fairly new phenomenon, and data are just now being collected and compiled. It is clear, however, that many factors contribute to these numbers, including tower location, design, wires, lighting, weather, and bird behavior. Towers located on KSC provide the opportunity for bird strikes because of its location along the Atlantic Flyway migration route. The coastline of Florida is used by birds as a guide to follow as they travel from

north to south in the fall and south to north in the spring. During a 10-year study (1970-1981) of birds killed by striking the VAB during inclement weather conditions, more than 5,000 birds representing 62 species were collected (Taylor and Kershner 1986). Several kills occurred during spring migration (March – May) and the majority occurred during fall migration (September – October). Lighting conditions at the VAB included well lit surroundings (other facilities, parking lots, etc.), lights on various levels of the VAB, and red and white lights on top of the VAB. Since the early 1980s, primarily in response to the huge increase in tall structures across the landscape, mitigation measures have been developed to reduce impacts to birds. Several of these have been incorporated into the LPS design and are discussed in Chapter 5. With mitigation plans in place, the impacts to migratory birds from the LPS are expected to be minor. Monitoring protocols to determine the effectiveness of the mitigation strategies are also included in Chapter 5.

### 4.2.3 Threatened and Endangered Species

Construction – Construction of the ML is not anticipated to produce any impacts to protected species.

All three species of sea turtles which nest on beaches near LC 39B are federally protected. Figure 4-2 shows the density of sea turtle nests (species combined) for 21 km north (Haulover Canal) and south (Cape Canaveral) of LC 39B for 2006. Construction activities related to tower modifications and LPS are anticipated to potentially increase sea turtle disorientation risks due to increased lighting necessary for nighttime construction activities. These lights would temporarily add to the illumination load already present at LC 39B, further escalating the risk of sea turtle disorientation. Some adult and hatchling disorientation is allowed to take place without legal consequences under a permit issued to KSC from the USFWS. The KSC Lighting Plan guidelines (NASA 2002b), developed as part of the permitting process, would be followed to the extent possible to help reduce impacts. During 2005 and 2006, the percentage of nests with disoriented hatchlings was nearly 12% and 4.5%, respectively (Holloway-Adkins and Small 2006), and KSC is currently in consultation with the USFWS to develop additional methods to reduce future impacts and mitigate for those that occur. Mitigation measures and the monitoring protocol are discussed in Chapter 5. Without mitigation, the impacts from the LPS construction and LC 39B modifications due to lighting could potentially be major; however, the mitigation is anticipated to reduce these impacts to a minor level.

Operation - No impacts to protected wildlife species are expected from operation of the ML or from LC 39B tower modifications.

Potential impacts to protected wildlife from operation of the LPS fall into two categories: 1) daytime bird strike risks from low-visibility structures and wires, and 2) sea turtle disorientation risks due to increased lighting.

The wetland habitats surrounding LC 39B provide excellent feeding habitat for several species of wading birds, including the federally endangered wood stork and six species protected by the State of Florida (Table 3-1). All of these birds are year-round residents at KSC and nest in colonies that are typically located on spoil islands in the nearby estuaries (Figure 3-1). Movement of large numbers of wading birds across the LC 39B area is very common as they travel from colonies to wetland feeding sites and from one feeding site to another. Wading birds are seen on a daily basis feeding in the water retention areas that are within the LC 39B perimeter fence. In addition, an average of 14 pairs of bald eagles nest on KSC each year during the

winter months (Figure 3-2), and non-nesting eagles can be found during all times of the year. The wetlands adjacent to LC 39B and the Atlantic Ocean provide food resources for this federally threatened species, and eagles are regularly seen perched on poles surrounding the pad.

The LPS structure, and particularly the grounding wires associated with the LPS, poses a strike risk to birds flying through the area. The mitigation measures detailed in Chapter 5 are expected to reduce these impacts potentially major to minor. A monitoring program, also discussed in Chapter 5 should quantify impacts and the efficacy of mitigation measures.

Once the LPS is in place, it would require full-time lighting to comply with FAA aircraft safety regulations. These lights would add to the illumination load already present at LC 39B, further increasing the risk of sea turtle disorientation. Some adult and hatchling disorientation is allowed to take place without legal consequences under a permit issued to KSC from the USFWS. The KSC Lighting Plan guidelines, developed as part of the permitting process, would be followed to the extent possible to help reduce impacts. During 2005 and 2006, the percentage of disorientations was more than 12% and 4.5%, respectively, and KSC is in consultation with the USFWS to develop additional methods to further reduce impacts and to mitigate for those that occur. Mitigation measures and the monitoring protocol are discussed in Chapter 5. Without mitigation, the impacts from the operation of the LPS due to lighting could potentially be major; however, the mitigation is anticipated to reduce these impacts to a minor level.

### 4.2.4 Cultural Resources

Construction

The proposed modifications to the FSS at LC 39B include an additional service arm and the removal of the GOX vent arm. The additional service arm would not substantially change the look or function of the launch tower. The removal of the GOX vent arm would change the function of the facility slightly, however, the arm itself would be stored as a spare part for potential use on LC 39A, and would not be destroyed for the remaining life of the Space Shuttle program. Given these conditions, NASA has determined that the proposed modifications do not constitute an "Adverse Effect" on this Historic Property.

The addition of the proposed LPS within the LC 39B perimeter would not impact the Historic Property. While this new structure is within the boundaries of the LC-39B Historic District, it is appropriate within the context of the District's form and function.

The impact level for these activities on cultural resources was established to be "none". A letter providing these data and NASA's determination of a no "Adverse Effect" was sent to the Florida State Historic Preservation Office in November 2006 (Appendix 4).

Operation

Operations involving the proposed activities would be similar to the operations of the Space Shuttle program. Therefore, no impacts or effects to the Cultural Resources at LC 39B are anticipated.

### 4.2.5 Geology and Soils

Construction - Activities at the ML or LC 39B tower would not affect geology or soil resources. No excavations, drilling, or other earth removal would be required at these construction locations.

The LPS construction activities at LC 39B would have potential minimal impacts to geology and soils due to site preparation and assembly of the structures' foundations. LC 39B is a designated Solid Waste Management Unit (SWMU) (NASA 2004b). Contaminants of concern identified in LC 39B soils are benzo(a)pyrene, polychlorinated biphenyls, arsenic, and nickel.

Because the construction of the LPS would require soil excavation and possible dewatering, solid waste management considerations have been included in the design criteria of both activities. The management, treatment, and/or disposal of impacted soils and water would be conducted in accordance with federal and state regulations, as well as KSC environmental policies and procedures (NASA 2004b).

Operation - During their operation, none of the three activities included in the Proposed Action would have an impact on geology or soils.

### 4.2.6 Noise

Construction - Noise generated during the construction phases of the three activities would potentially have discernable, but temporary effects on wildlife occurring nearby. Construction would take place in developed areas that already experience noise associated with heavy industry and vehicles. The majority of research related to the effects of noise on wildlife has been conducted on laboratory animals and the results extrapolated (Brown 2001). Some buffering of noise is afforded to wildlife by vegetation; attenuation rates of up to 10 dBA per 100 m (328 ft.) have been demonstrated in vegetated areas (Price et al. 1988). Given that rate, noise would be expected to carry 300 - 400 m (984 - 1,312 ft.) away from the construction sites. Beyond this distance, noise levels would be lower than what has been experimentally shown to have deleterious effects on animals (Brown 2001). Wildlife occurring closer to noise sources would be free to move away or find shelter (e.g., burrows); no wading bird colonies (Figure 3-1), documented eagle nests (Figure 3-2), or other protected bird species' nesting habitat is within 400 m (1,312 ft.). Therefore, noise impacts are expected to be minimal.

Operation – No environmental consequences related to noise are expected from operations associated with any of the three activities.

### 4.2.7 Surface Water Quality

Construction – Construction would not impact surface water quality at the three locations identified in the Proposed Action.

Operation - During their operational phases, the three activities included in the Proposed Action alternative would not impact surface water quality.

### 4.2.8 Groundwater Quality

Construction - Activities at the ML or LC 39B tower would not affect groundwater resources. No excavations, drilling, or other earth removal would be required at these construction locations.

The LPS construction activities at LC 39B would have potential minimal impacts to groundwater due to site preparation and assembly of the structures' foundations. LC 39B is a designated SWMU (NASA 2004b). Contaminants of concern identified in LC 39B groundwater are volatile organic compounds and metals (NASA 2004b). Institutional controls established in the Resource Conservation and Recovery Act permit for the site would be followed.

Operation - During their operational phase, none of the three activities would have an impact on groundwater quality.

### 4.2.9 Socioeconomics

Construction - A total of 500-750 construction workers are expected to be required for the construction of the Proposed Action alternative activities. These would be drawn from the local workforce with an anticipated positive impact to the area's economy. Given the large numbers of construction workers already employed at KSC, this impact to socioeconomics and the local workforce would likely be minimal.

Operation - During their operational phase, the three activities are not anticipated to have an impact on socioeconomics.

## 4.3 Cumulative Impacts

The cumulative impacts addressed in this section are those relating only to the activities included in this EA. Cumulative impacts potentially resulting from the entirety of the Constellation Program will be addressed in the Constellation Programmatic EIS scheduled to be completed no later than June 2008.

### 4.3.1 No Action Alternative

If no action is taken, major cumulative impacts are anticipated for the local economy. The Space Shuttle would be retired and associated programs discontinued, causing loss of jobs on KSC, loss of ancillary jobs in the surrounding communities, and a reduction in employment in construction and other related support functions. Besides those occurring related to socioeconomics, no other cumulative impacts are expected from the No Action alternative.

### 4.3.2 Proposed Action Alternative

Construction and operation of one of the three activities (ML) would not be expected to result in cumulative impacts to any environmental resources. Impacts from the ML tower lighting during construction are expected to be reduced to a minimal level by instituting mitigation measures (Chapter 5). The operational phases of the activities would be replacing Space Shuttle operations; no new or additional impacts are anticipated from these Constellation Program activities. An EIS addressing the totality of potential environmental impacts from the Constellation Program is currently being prepared and is expected to be published in 2008.

Construction activities at LC 39B (tower modifications and LPS), as well as operations of the LPS, could result in cumulative impacts to sea turtle populations that nest on adjacent beaches. Increased lights are positively correlated with increased disorientation rates (Witherington and Martin 1996). Additional lights would necessitate more aggressive mitigation in order to offset impacts, and monitoring the efficacy of the mitigation strategies should be required. These activities are described in Chapter 5.

Nighttime bird and bat strikes, and daytime bird strikes would also potentially increase due to a greater number of structures present at the LC 39B area. Lighting on the structures would intensify strike possibilities, particularly under adverse weather conditions during the spring and fall when birds are migrating along the coast. Mitigation methods in Chapter 5 are expected to reduce these impacts to a minimal level. Over the course of time, unused/abandoned tall structures should be removed from the landscape to help reduce the number of strike hazards.

Table 4-1. Expected levels of impacts to resources from activities associated with the Constellation Program that are included in this Environmental Assessment under the Proposed Action alternative. See section 4.1 for a description of impact levels.

| **Resource** | **Activity** | | |
|---|---|---|---|
| | ***ML*** | ***LC 39B Tower*** | ***LPS*** |
| **Air Quality** | | | |
| Construction | minimal | minimal | minimal |
| Operation | minimal | minimal | minimal |
| **Biological Resources** | | | |
| *Habitats/Vegetation* | | | |
| Construction | none | none | none |
| Operation | none | none | none |
| *Wildlife* | | | |
| Construction | minimal | minor* | minor* |
| Operation | none | none | minor* |
| **Threatened and Endangered Species** | | | |
| Construction | none | minor* | minor* |
| Operation | none | none | minor* |
| **Cultural Resources** | | | |
| Construction | none | none | none |
| Operation | none | none | none |
| **Geology and Soils** | | | |
| Construction | none | none | minimal |
| Operation | none | none | none |
| **Noise** | | | |
| Construction | minimal | minimal | minimal |
| Operation | none | none | none |
| **Surface Water Quality** | | | |
| Construction | none | none | none |
| Operation | none | none | none |
| **Groundwater Quality** | | | |
| Construction | none | none | minimal |
| Operation | none | none | none |
| **Socioeconomics** | | | |
| Construction | minimal | minimal | minimal |
| Operation | none | none | none |
| * Impacts to these resources from these activities could potentially be major. However, mitigation measures are expected to reduce the impact levels to minor. | | | |

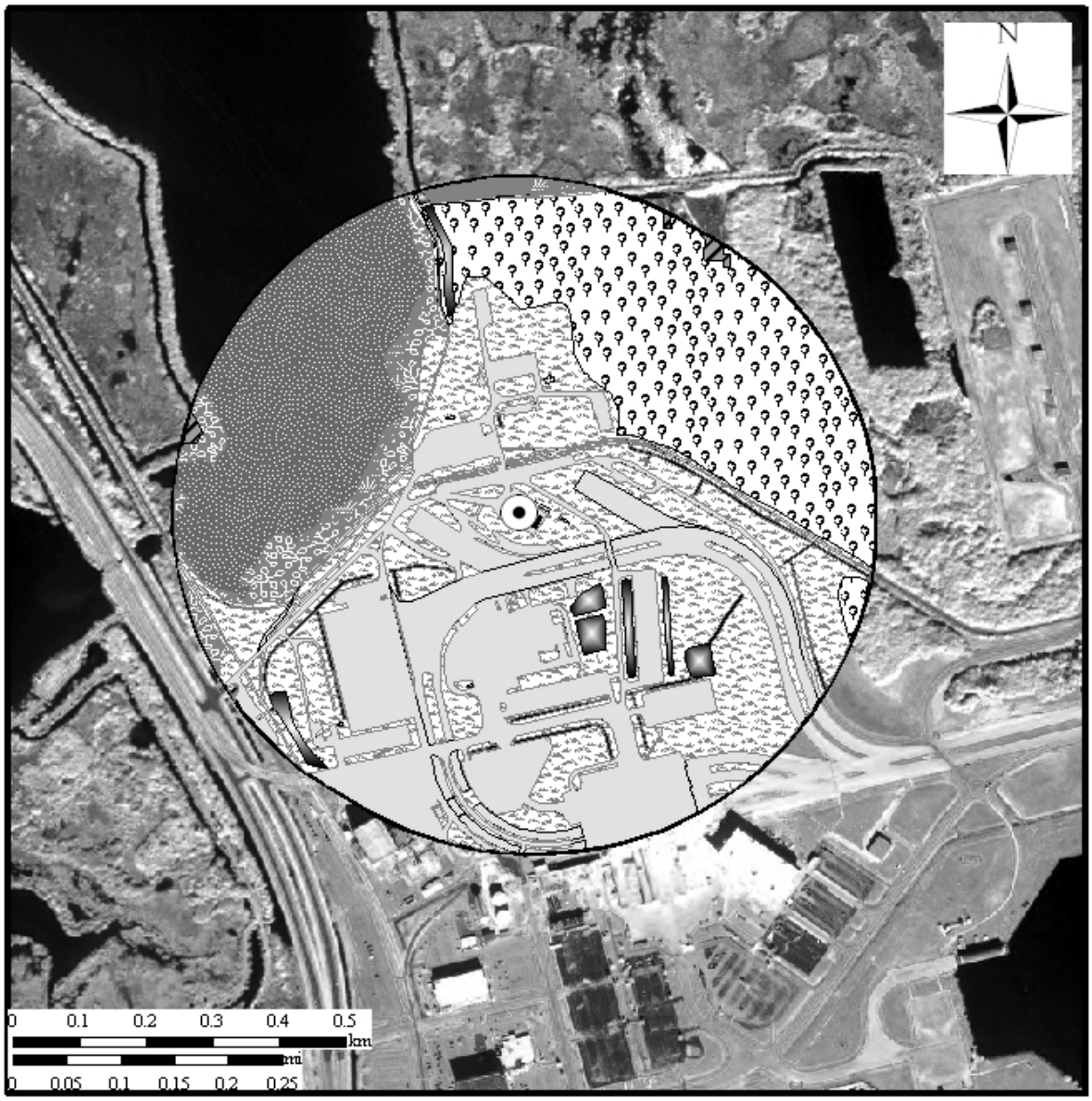


Figure 4-1a. Land Cover within a 0.5 km radius buffer from outer edge of the ML facilities.

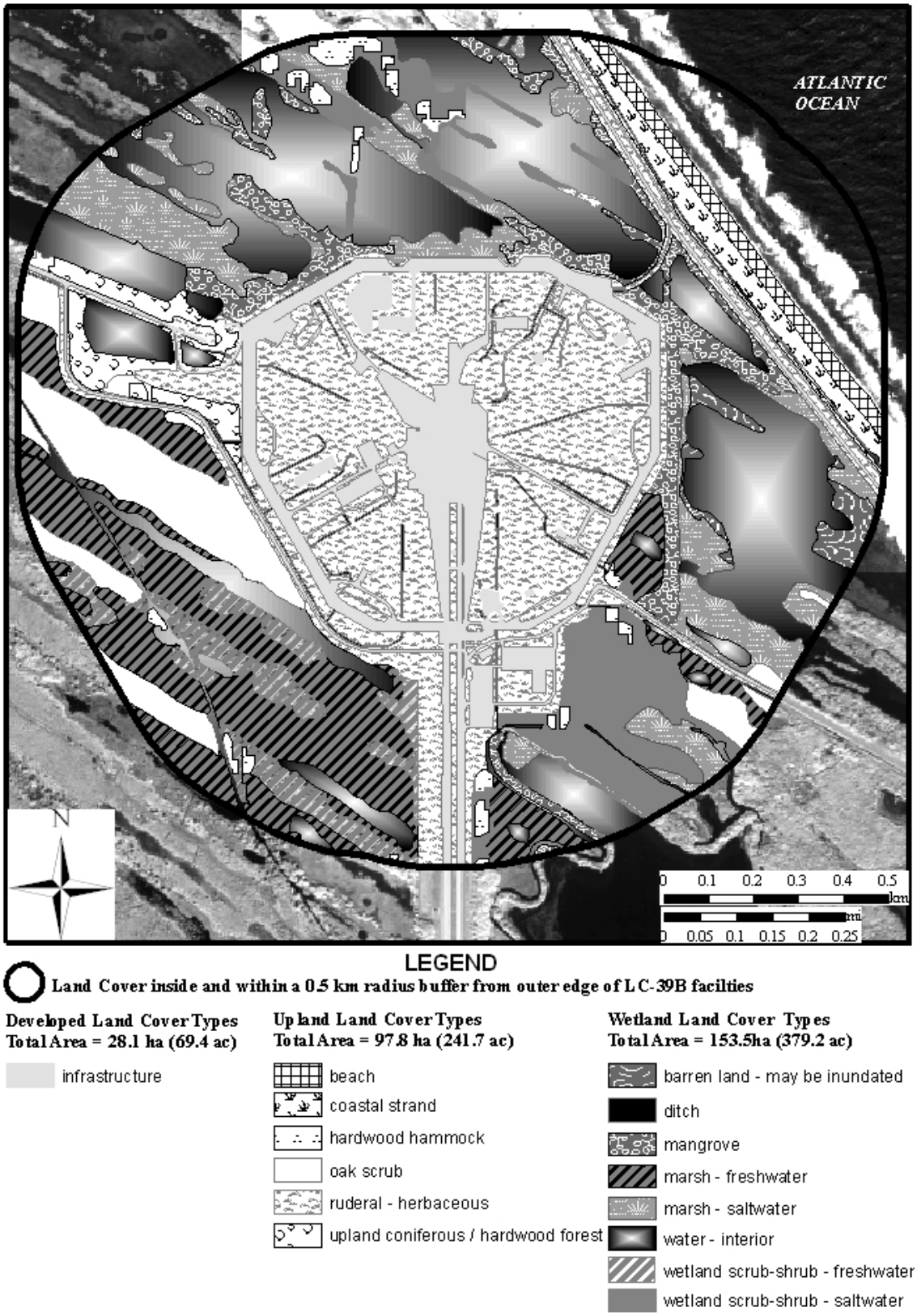


Figure 4-1b. Land Cover within a 0.5 km radius buffer from outer edge of LC 39B facilities.

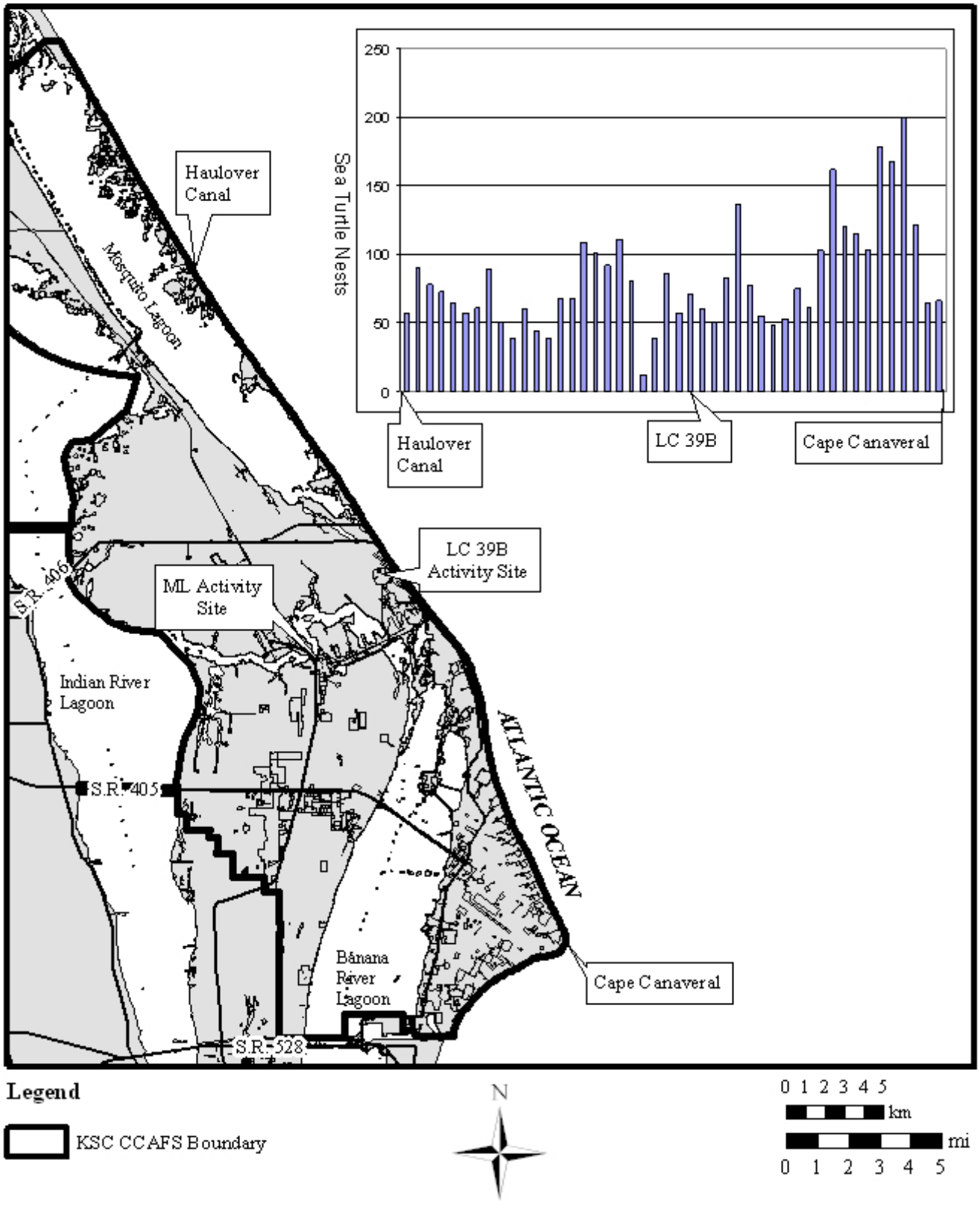


Figure 4-2. Number of sea turtle nests within 21 km (13 mi.) north and south of LC 39B, 2006.

# 5.0 Mitigation and Monitoring

## 5.1 Mitigation Strategies

Chapter 4 describes the potential impacts from the activities in the Proposed Action alternative. Specific activities that would require mitigation are the ML and LPS The impacts that might result fall into three categories: 1) nighttime bird and bat strike risks due to tall, lit structures and wires, 2) daytime bird strike risks from low-visibility structures and wires, and 3) sea turtle disorientation risks due to artificial lighting illuminating the nesting beach. All of these phenomena have become more common with the dramatic increase in the number of towers across the landscape. As a result, much research has been done to determine methods of eliminating or reducing impacts. Some of these mitigation strategies would be incorporated into the design of the structures, and others would be instituted once operations begin. Appendix 4 is a Memorandum of Record detailing the mitigation strategies investigated, and the rationale of why they could be accepted or rejected. A summary of the mitigation strategies that would be used is given in the following sections.

### 5.1.1 Structural Mitigation Strategies

The height of towers directly influences the numbers of birds killed; towers greater than 305 m (1,000 ft.) are responsible for the most mortalities. However, the addition of lights can attract birds and cause them to strike towers of any size (Manville 2005). For that reason, the USFWS recommends that towers be less than 61 m (200 ft.) tall, which is the shortest tower that can be unlit according to FAA regulations (USFWS 2000). None of the towers planned for the Proposed Action alternative could be less than 61 m (200 ft.) and accomplish their objectives. The minimum height for the ML tower necessary to support the height and weight of the launch vehicles would be 122 m (400 ft.). The three towers that comprise the LPS (reduced from the original design of four towers) could be no shorter than 184 m (605 ft.) and still provide adequate lightning protection for the launch vehicles and associated launch pad structures (NASA 2007). This height was reduced from the original design concept of 204 m (668 ft.) (Reynolds, Smith, and Hills, Inc. 2006).

It has been documented that guy wires associated with towers add to the bird strike potential, and the effect is exacerbated by lights (Manville 2000). The ML tower or the LPS towers would not be guyed, but there would be nine wires attached to the LPS needed to carry electrical current to the ground after a lightning strike, as well as a matrix of five horizontal wires strung between the towers (Fig. 2.3). (There would be no wires needed for the ML). Nine grounding wires would be the absolute minimum necessary to afford adequate lightning protection. The angle between the wires and the towers would be the smallest possible required without incurring an unacceptable level risk of electric current jumping from the wires to the vehicle immediately after a lightning strike. A smaller angle between the wires and towers would decrease the overall impact footprint. To increase visibility, the wires would be the largest diameter possible that could be structurally supported by the towers and connections, and would be made of non-coated stainless steel that would retain its brightness and reflective nature in the corrosive coastal environment. Markers would be placed on wires in accordance with FAA guidelines at heights with access for installation and maintenance.

Because of the heights of the ML and LPS towers, FAA-required lighting would be mandatory. The proposed designs of both

activities have incorporated the minimum number and intensities of lights required, with the longest duration of dark between flashes. These parameters are in accordance with the USFWS tower guidelines (USFWS 2000). In addition, the KSC Exterior Lighting Guidelines would also be followed (NASA 2002). Only one of the three LPS towers would be located on the east side of the LC 39B pad (adjacent to the beach) in order to minimize the light visible from lower levels of the towers on the beach.

### 5.1.2 Operational Mitigation Strategies

Lighting on the LPS towers, besides that required by the FAA, would be necessary in the event that people would be working after dark. This would be a rare occurrence given the safety concerns associated with working at such heights and in small quarters, but could happen under some conditions. Lighting must meet National Fire Protection Association illumination standards to allow for personnel to safely walk on the platforms at night. The current design calls for low pressure sodium lights, shielded and positioned to minimize ambient lighting effects. Actual work would be done with user-provided task lighting. Tower lights would normally be "off" by default, would have to be manually turned on before work could be conducted, and would have timer switches to prevent them from being left on beyond the time needed.

The platforms at four levels of the LPS towers potentially provide suitable substrate for bird nests, particularly ospreys, red-tailed hawks, and great horned owls. Regularly scheduled surveys of the platforms would occur every two or three days during the osprey/red-tailed hawk nesting season (February through April). Any nesting material found would be removed immediately in order to prevent egg deposition. Great horned owls typically do not build intricate nests and will deposit their eggs on bare ground or debris. The open grating of the platforms would not provide preferred nesting substrate for great horned owls unless there was something lying on top of the grating; therefore, it would be imperative that all soft debris such as material and rope be kept off of the platforms.

A very important component of the mitigation strategy for the LPS would be worker education. Those people that occupy LC 39B on a daily basis should be trained to recognize and prevent potential wildlife problems. This training should include recognition of those bird species that might nest on the structures, what bird behaviors are indicative of nest-building, procedures for retrieving and reporting dead birds or bats found inside the launch pad perimeter fence, and procedures for reporting unnecessary lighting.

## 5.2 Monitoring Strategies

### 5.2.1 Sea Turtle Disorientation Monitoring

Monitoring the effects of lighting from KSC facilities on sea turtles has been occurring since 2000. In a draft Biological Opinion written for NASA by the USFWS in 2006, a disorientation rate of 2% for adults and 2% for hatchlings was permitted. In return, NASA (through the Life Science Services Contract and MINWR) agreed to monitor sea turtle nesting on the adjacent beaches, record and report disorientation events, work to minimize impacts from lighting, and mitigate for unavoidable impacts.

Currently, disorientation monitoring is accomplished with several tasks. Surveys of facility lighting from the nesting beaches are done to determine sources of impacts, and these sources are reported to the appropriate KSC or CCAFS environmental programs. Facility managers are offered opportunities for consultation with biologists who provide site-

specific suggestions to eliminate or reduce impacts, without compromising the facility's mission. Adult sea turtle disorientation events are documented in conjunction with the daily nest surveys conducted from mid-May through the end of August. Hatchling disorientation surveys are done three or four times per week from mid-May through October. In addition, nests are shielded that are expected to be at risk for disorientation due to timing, their location, and lights that cannot be eliminated. Results from all of these tasks are reported to the USFWS, and subsequent mitigation and monitoring strategies are designed to address issues and further reduce impacts.

All of these components of the disorientation monitoring take approximately one man-year of effort to accomplish. Conditions and/or requirements for the LPS disorientation monitoring are not expected to change significantly from those currently experienced during the Space Shuttle program. Therefore, the current monitoring program would be sufficient.

### 5.2.2 Bird and Bat Strike Monitoring

The USFWS Division of Migratory Bird Management has researched and designed monitoring protocol that are believed to sufficiently detect bird strike mortalities from tall structures and associated wires (Manville 2002). The following proposed monitoring protocol for the LPS is based on those recommendations.

Concentric circles with a radius of 183 m (600 ft.) would be searched for bird and bat carcasses at each of the three towers (Figure 5-1). Because these circles would lie entirely within mowed grass or concrete, detection rates would be excellent with surveys done on foot or with a four-wheeler. Surveys would occur daily immediately after dawn during the spring (mid-March – May) and fall (September – October) migration seasons. Surveys would also be done when weather conditions the previous night included fog or very low cloud cover at LC 39B. Carcasses would be removed, identified to species, and documented. All grounding wires would be inspected for entangled birds using binoculars or a spotting scope. During times other than those noted above, routine pad personnel would be trained to detect and retrieve carcasses, and to report bird or bat strike incidents (see Section 5.1.2). This monitoring effort would occur for three years following completion of the first tower, with a review at the end of the third year to determine if changes in protocol are needed, or if monitoring could be discontinued. Reports would be given to the USFWS Division of Migratory Bird Management each year at the conclusion of the fall migration season. Approximately 300 hours would be required each year for the bird strike monitoring.

On those infrequent occasions that the ML would not be parked either at the launch pad or inside the VAB, strike monitoring would depend on trained personnel working in the vicinity of the tower. Particular attention would be paid to the area surrounding the ML on mornings after weather conditions the previous night included fog or very low cloud cover. Personnel working in the vicinity of the ML would be trained in the same manner as LC 39B personnel (Section 5.1.2).

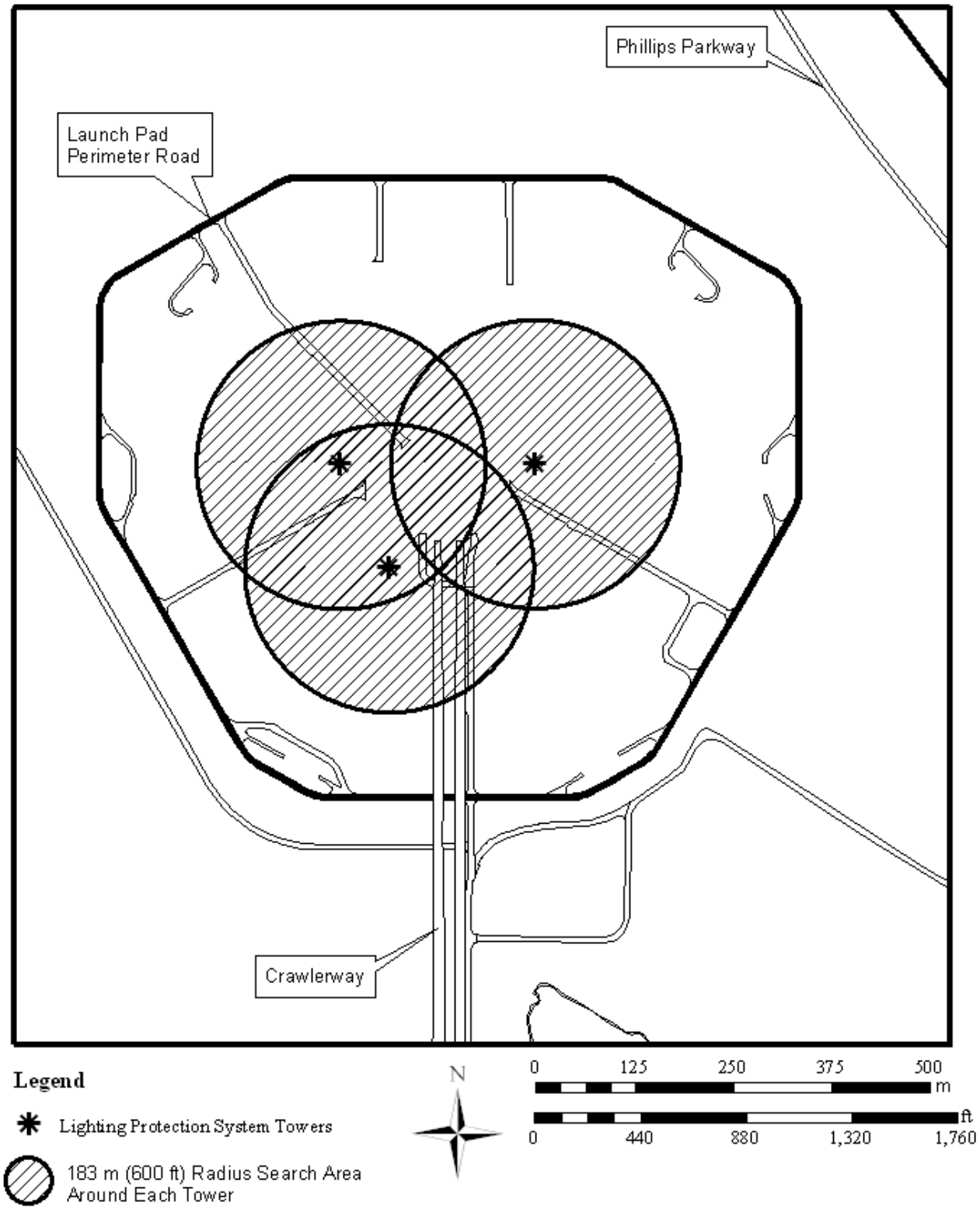


Figure 5.1. Bird and bat strike search areas (three 183 m / 600 ft. radii circles) surrounding each of the proposed LPS towers.

# 6.0 Environmental Justice

On February 11, 1994, the President of the U.S. signed Executive Order (EO) 12898, entitled, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations." The general purposes of the EO are to: 1) focus the attention of Federal Agencies on the human health and environmental conditions in minority and low-income communities with the goal of achieving environmental justice; 2) foster non-discrimination in Federal programs that substantially affect human health or the environment; and 3) give minority and low-income communities greater opportunities for public participation in, and access to, public information on matters relating to human health and the environment.

The EO directs federal agencies, including NASA, to develop environmental justice strategies. Further, EO 12898 requires NASA, to the greatest extent practicable and permitted by law, to make the achievement of environmental justice part of NASA's mission. Disproportionately high adverse human health or environmental effects on minority or low-income populations must be identified and addressed. In response, NASA established an agency-wide strategy, which, in addition to the requirements set forth in the EO, seeks to: 1) minimize administrative burdens; 2) focus on public outreach and involvement; 3) encourage implementation plans tailored to the specific situation at each Space Center; 4) make each Center responsible for developing its own Environmental Justice Plan; and, 5) consider both normal operations and accidents. KSC has developed a plan to comply with the EO and NASA's agency-wide strategy.

Neither the No Action alternative nor the Proposed Action alternative would be expected to produce any consequences related to Environmental Justice. The proposed activities would be implemented within the boundaries of KSC. The closest residential areas are 13 km (9.5 mi.) south on Merritt Island, and 12 km (7.6 mi.) west in Titusville; the distances of these areas from the activity sites preclude any direct impacts from construction or operations. Economic impacts are not expected to adversely affect any particular group. Construction personnel would be drawn from the local workforce and provide short-term economic benefits to the local area. Personnel needed for operations would not be increased.

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| Stolen, Eric | Dynamac Corporation | Biologist | Data for Wildlife sections |
| Taff, Ed | NASA KSC, Airfield Operations | Shuttle Landing Facility Operations Officer | Consultation for FAA lighting requirements for LPS |
| Van Den Ende, Oliver | Dynamac Corporation | Environmental Scientist | Data and text; Document administration |

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Appendix 1A. Categorical exclusion documentation for LCC Firing Room 1, KSC, Florida.

## Avoid Verbal Orders

**TO:** TA-D1/Environmental Coordinator **DATE:** 12/8/2006

**FROM:** TA-C3/Lead, NEPA Compliance

**SUBJECT:** KSC Record of Environmental Consideration (REC)

**1. PROJECT INFORMATION**

**Project Title:** Modifications to Firing Room 1 for Constellation Program, LCC, K6-900

**Project Lead:** Dung Trang, DX-D2, 1-2266 **Directorate Project No.:** 98604

**EPO Reviewer:** LPH **Environmental (ENV) No.:** N/A

**2. NEPA DETERMINATIONS**

- ☑ **a. Categorical Exclusion per 14 CFR Part 1216.305(d)**
- ☐ **b. Environmental Assessment (EA) Required per KHB 8800.6**
- ☐ **c. Environmental Impact Statement (EIS) Required per KHB 8800.6**
- ☐ **d. Project on CCAFS:**

**3. ENVIRONMENTAL REQUIREMENTS**

| | | |
|---|---|---|
| **a. Non-Permit Requirements** | ☑ **YES** | ☐ **NO** |
| **b. Permit Requirements** | ☐ **YES** | ☑ **NO** |

**********Original REC issued 6/28/2006 FXK**********
**********UPDATED 9/13/2006 LPH **********
**********UPDATED 12/8/2006 LPH (Revise NEPA determination from EA to CATEX)**********

The NASA Environmental Program Branch (EPB, TA-C3) has assigned Patrice Hall, CHS-156, 867-8430 as the Environmental Point Of Contact (EPOC) for this project. Please add Ms. Hall's name to any lists or notifications of meetings related to this project. All questions relating to environmental issues should be forwarded to the EPOC section within the NASA EPB (John Shaffer, TA-C3, 7-8448).

2.a.1 CATEGORICAL EXCLUSION (CATEX): Given the nature of the proposal, this office has determined that the project currently qualifies for a Categorical Exclusion (CATEX) under federal regulations (14 CFR 1216.305(d)(8)).

3.a.1. HISTORIC PROPERTY: This project proposes modifications to the Launch Control Center (LCC) which is part of the Launch Complex 39 National Historical District and is a listed historical property. The LCC firing rooms are listed as historical. The NASA Environmental Program Office (Mario Busacca, TA-C3, 7-8456) has completed consultation with the State Historical Preservation Officer (SHPO) detailing the proposed changes and requesting clarification on any requirements.

3.a.2. HAZARDOUS AND CONTROLLED WASTE (ASBESTOS CONTAINING MATERIAL): This is a regulated material that can no longer be used in construction materials. Asbestos was incorporated into many building products and most commonly found in floor tiles, roofing materials, caulking compounds, and insulation media. If this project will disrupt construction materials, an asbestos survey should be done if one has not already been completed. Contact JBOSC Environmental Health at 867-2400 for support. JBOSC Environmental Health has completed a KSC-wide asbestos survey and the data is complied on the KSC Environmental Health Asbestos Survey Data Home Page (See link: (<http://amis)). If it is known that asbestos exists and will be disturbed, regulations from 62-257 F.A.C. must be followed and notification to the NASA Environmental Program Office (TA-C3, 867-8428) is required. If less than 260 linear feet, or less than 160 square feet of regulated asbestos containing material (RACM) is to be removed, there are no fee or reporting requirements to the FDEP, unless there is demolition of any load-supporting structural member. If the removal trips these thresholds, or is greater than 1 cubic meter, or 35 cubic feet, regulations require a notification to FDEP. The "Notice of Asbestos Renovation or Demolition" (DEP Form Number 62-257.900(1)) can be found on the FDEP website under "Asbestos Notification" at: http://www.dep.state.fl.us/air/forms.htm. The Permitting and Compliance Group within TA-C3 Environmental Program Office must be copied on all reports submitted to FDEP. For asbestos disposal, SGS Waste Management can supply directions on proper handling, storage, and disposal of the waste stream though the Process Waste Questionnaire/Technical Response Package (PWQ/TRP) process. Please contact SGS Waste Management Services at 867-8642 for assistance.

## Avoid Verbal Orders

**TO:** TA-D1/Environmental Coordinator **DATE:** 12/8/2006

**FROM:** TA-C3/Lead, NEPA Compliance

**SUBJECT:** KSC Record of Environmental Consideration (REC)

3.a.3. HAZARDOUS/NON-HAZARDOUS WASTE: All hazardous waste and non-hazardous wastes generated on KSC must be managed, controlled and disposed of per the KSC Waste Management requirements outlined in the KNPR 8500.1. A Process Waste Questionnaire (PWQ), KSC Form 26-551 along with any supporting documentation (MSDS, product formulation) must be submitted to the CHS Waste Management Office for each waste stream generated. That office will then generate a Technical Response Package (TRP) which will give direction on proper handling, storage, and disposal of the waste stream. Please contact CHS Waste Management Services at 867-8640 if assistance is required.

3.a.4. HAZARDOUS AND CONTROLLED WASTE (PAINT): This project may involve disturbance/removal of paint coatings. Unless known to be non-hazardous, the coatings should be sampled and analyzed for the 8 RCRA hazardous metals, to include, lead, cadmium, chromium and PCBs. Analysis should be performed by an AIHA certified laboratory. The requirements established in OSHA standards 29 CFR 1926.62 & 29 CFR 1926.1127 for lead and cadmium respectively must be complied with if lead and/or cadmium are present. If the coatings contain heavy metals, it is recommended that the control zone and personal protective equipment requirements established in the lead standard be complied with to prevent exposure to workers and adjacent unprotected areas. The sampling analysis will dictate the level of PPE required and the handling/disposal requirements - see your company IH specialist for recommendations.

3.b.1. WATER RESOURCE PERMITTING (FIREX SYSTEM): If modifications are interior to the building envelope, no permit is required. Although no permit is specifically required, any work done will be per standards and criteria that would have been required had there been a permit issued by the Department and, not jeopardize the health and safety of personnel due to effects of the construction/modification on the KSC PW system (i.e. backflow preventers will be installed as required per KSC-STD-Z-0013 and standard engineering practice; disinfection and verification prior to use). The organization responsible for the work will ensure that best engineering practices, codes, specifications and standards are followed. Pressure and leak tests as well as disinfection are also required. If modifications are being considered outside the building, a permit may be required. Contact Doug Durham (867-8429) for further assistance if required.

No other environmental issues were identified based upon the information provided in the KSC Checklist. This Record of Environmental Consideration (REC) does not relinquish the project lead from obtaining and complying with any other internal NASA permits or directives necessary to ensure all organizations potentially impacted by this project are notified and concur with the proposed project.

Due to potential changes in regulations, permit requirements and environmental conditions, statements in this REC are valid for 6 months, and subject to review after this period. The Environmental Program Branch (EPB) will be reviewing open projects twice a year for possible impacts from changes in contaminated sites. If impacts are foreseen, EPB will notify the project lead with a new REC. It is the responsibility of the project lead to notify EPB if the scope of the project (including the design) has changed since the original checklist was submitted.

CC: D. Trang/DX-D2
P. Hall/CHS-156
***** Approved 12/8/2006 3:38:19 PM, Busacca, Mario *****
***** Deapproved 12/11/2006 8:27:32 AM, LPH *****

**4 Upon evaluation of the subject project, the above determinations have been made and identified. Contact the Environmental Program Office (TA-C3) at 867-8456 for re-evaluation should there be any modifications to the scope of work.**

K. Manguikian

**12/11/2006 9:27:32 AM**

**Kim Manguikian** **Date**

Appendix 1B. Categorical exclusion documentation for MLP 1, KSC, Florida.

## Avoid Verbal Orders

**TO:** LX Environmental Coordinator **DATE:** 2/16/2007

**FROM:** TA-C3/Lead, NEPA Compliance

**SUBJECT:** KSC Record of Environmental Consideration (REC)

**1. PROJECT INFORMATION**

**Project Title:** MLP-1 Mods for Ares I

**Project Lead:** Larry L. Schultz, LX-D1, 867-8803 **Directorate Project No.:** LX-2-07

**EPO Reviewer:** LPH **Environmental (ENV) No.:** N/A

**2. NEPA DETERMINATIONS**

- ☑ **a. Categorical Exclusion per 14 CFR Part 1216.305(d)**
- ☐ **b. Environmental Assessment (EA) Required per KHB 8800.6**
- ☐ **c. Environmental Impact Statement (EIS) Required per KHB 8800.6**
- ☐ **d. Project on CCAFS:**

**3. ENVIRONMENTAL REQUIREMENTS**

| | | |
|---|---|---|
| **a. Non-Permit Requirements** | ☑ **YES** | ☐ **NO** |
| **b. Permit Requirements** | ☑ **YES** | ☐ **NO** |

The NASA Environmental Program Branch (EPB) has assigned Lisa Ruffe (CHS-156, 867-6694) as the Environmental Point Of Contact (EPOC) for this project. Please add Ms. Ruffe's name to any lists or notifications of meetings related to this project during the study and design phases. All questions relating to environmental issues should be forwarded to the EPOC section within the NASA EPB.

3.a.1. HAZARDOUS/NON-HAZARDOUS WASTE: All hazardous waste and non-hazardous wastes generated on KSC must be managed, controlled and disposed of per the KSC Waste Management requirements outlined in KNPR 8500.1. A Process Waste Questionnaire (PWQ), KSC Form 26-551 along with any supporting documentation (MSDS, product formulation, lab analyses) must be submitted to the CHS Waste Management Office for each waste stream generated. That office will then generate a Technical Response Package (TRP) which will give direction on proper handling, storage, and disposal of the waste stream. Please contact CHS Waste Management Services at 867-8640 if assistance is required.

3.a.2. HAZARDOUS AND CONTROLLED WASTE (PAINT): This project may involve disturbance/removal of paint coatings. The coatings should be sampled and analyzed for PCBs and hazardous metals, to include, lead, cadmium, and chromium. Analysis should be performed by an AIHA certified laboratory. The requirements established in OSHA standards 29 CFR 1926.62 & 29 CFR 1926.1127 for lead and cadmium respectively must be complied with if lead and/or cadmium are present. If heavy metals are present, it is recommended that the control zone and personal protective equipment requirements established in the lead standard be complied with to prevent exposure to workers and adjacent, unprotected personnel. If the coatings are not analyzed for hazardous metals content, they must be treated as if the metals are present and the requirements of the standards must be complied with. All personnel who must utilize respiratory protection must comply with the requirements established in OSHA standard 29 CFR 1910.134 for respiratory protection.

SPECIAL NOTE (HOT WORK ON COATED METAL): Where possible, hot work on painted/coated metal structures should be avoided. If hot work is necessary, affected paint/coating must be sampled for PCBs to determine if additional respiratory protection is required. Degradation of PCBs occur under moderate/extreme thermal conditions (such as torch work) causing PCB materials to degrade into dioxins and other by-product chemicals. Please consult with your organization's Industrial Hygiene representative prior to conducting hot work on any painted/coated surfaces.

3.a.3. HAZARDOUS/NON-HAZARDOUS WASTE (SANDBLASTING): All hazardous waste and non-hazardous wastes generated on KSC during paint removal/sandblasting/surface prep operations must be managed, controlled and disposed of per KNPR 8800.7. All practical precautions must be taken to eliminate the possibility of a release of materials or waste (primers/paints/blasting debris from the paint surface preparation operations) to the surrounding environment. Please follow the abovementioned PWQ/TRP process when managing your waste. Contact CHS Waste Management Services at 867-8640 for assistance.

## Avoid Verbal Orders

**TO: LX Environmental Coordinator** **DATE: 2/16/2007**

**FROM: TA-C3/Lead, NEPA Compliance**

**SUBJECT: KSC Record of Environmental Consideration (REC)**

3.a.4. HISTORIC PROPERTY: The Mobile Launcher is listed as KSC historical property. However, a review of the project indicates that the construction is reversible and therefore will not have an adverse effect on the historical integrity of the Mobile Launcher. Notification to the State Historical Preservation Officer will not be required. All questions relating to the historical significance of this project should be forwarded to the NASA Environmental Program Branch (Mario Busacca, TA-C3, 7-8456).

3.a.5. AFFIRMATIVE PROCUREMENT (AP): Federal agencies and their contractors are required to purchase products made from recycled or recovered materials whenever possible. Detailed information on EPA approved products is available at www.epa.gov/cpg/products.htm. A Request for Waiver Form (KSC 28-825 NS) must be submitted for the purchase of items that are on the Comprehensive Procurement Guidelines (CPG) list but were replaced with non AP approved items. Contact Maggie Forbes (867-3305) or Alice Smith (867-8454) with any questions on this requirement.

3.a.6. RECYCLING: The contractor must make every practical effort to reclaim and segregate materials that have the ability to be easily recycled. All reclaimed scrap metal must be transported to the RRMF with a KSC Form 7-49. Please turn these items and the KSC Form 7-49 into the Reutilization, Recycling and Marketing Facility (RRMF) personnel to ensure the proper disposition of the materials prior to leaving the recycling area. POC for this process is Jayne Bishop, 861-8795. For any other information regarding what materials can be recycled or general information regarding recycling policies at KSC, please contact the NASA Environmental Program Branch (Alice Smith, TA-C3, 867-8454).

3.b.1. WATER RESOURCES PERMITTING (Potable Water/FIREX): The proposed project may require a permit for the alteration or installation of utilities to transport potable water. Information for review to determine permit requirements should be submitted to the NASA Permitting and Compliance Group (Doug Durham,TA-C3, 867-8429). Additionally, any work done will be per standards and criteria set forth in the permit requirements and will not jeopardize the health and safety of personnel due to effects of the construction/modification on the KSC Potable Water system. Backflow preventers will be installed as required per KSC-STD-Z-0013 and standard engineering practice. The organization responsible for the work will ensure that best engineering practices, codes, specifications and standards are followed. Pressure and leak tests as well as disinfection are also required. Contact Doug Durham (867-8429) for permit requirement determination and if further assistance is required .

3.b.2. WATER RESOURCES PERMITTING (Domestic Wastewater Collection and Transmission): The proposed project may require a permit for the alteration or installation of utilities to transport domestic wastewater. Please submit the necessary design information to the NASA Permitting and Compliance Group for determination of permit requirements (Doug Durham, TA-C3, 867-8429).

No other environmental issues were identified based upon the information provided in the KSC Checklist. This Record of Environmental Consideration (REC) does not relinquish the project lead from obtaining and complying with any other internal NASA permits or directives necessary to ensure all organizations potentially impacted by this project are notified and concur with the proposed project.

Due to potential changes in regulations, permit requirements and environmental conditions, statements in this REC are valid for 6 months, and subject to review after this period. The Environmental Program Branch (EPB) will be reviewing open projects twice a year for possible impacts from changes in contaminated sites. If impacts are foreseen, EPB will notify the project lead with a new REC. It is the responsibility of the project lead to notify EPB if the scope of the project (including the design) has changed since the original checklist was submitted.

cc: L. Schultz/LX-D1
M. Busacca/TA-C3
L. Ruffe/CHS-156

**4 Upon evaluation of the subject project, the above determinations have been made and identified. Contact the Environmental Program Office (TA-C3) at 867-8456 for re-evaluation should there be any modifications to the scope of work.**

**Avoid Verbal Orders**

**TO:** LX Environmental Coordinator **DATE:** 2/16/2007

**FROM:** TA-C3/Lead, NEPA Compliance

**SUBJECT:** KSC Record of Environmental Consideration (REC)

K. Manguikian

2/16/2007 1:09:23 PM

Kim Manguikian — Date

Appendix 1C. Categorical exclusion documentation for the O & C High Bay, KSC, Florida.

## Avoid Verbal Orders

**TO:** Lockheed Martin Space Systems **DATE:** 2/22/2007

**FROM:** TA-C3/Lead, NEPA Compliance

**SUBJECT:** KSC Record of Environmental Consideration (REC)

**1. PROJECT INFORMATION**

**Project Title:** Demolition/Modification/Rehabilitation of O&C High Bay for ORION Program

**Project Lead:** Jules Schneider, Mail Code 3930, 867-8111 **Directorate Project No.:** CONSTELLATION PROG/ORION

**EPO Reviewer:** LPH **Environmental (ENV) No.:** N/A

**2. NEPA DETERMINATIONS**

- ☑ **a. Categorical Exclusion per 14 CFR Part 1216.305(d)**
- ☐ **b. Environmental Assessment (EA) Required per KHB 8800.6**
- ☐ **c. Environmental Impact Statement (EIS) Required per KHB 8800.6**
- ☐ **d. Project on CCAFS:**

**3. ENVIRONMENTAL REQUIREMENTS**

| | | |
|---|---|---|
| **a. Non-Permit Requirements** | ☑ **YES** | ☐ **NO** |
| **b. Permit Requirements** | ☑ **YES** | ☐ **NO** |

3.a.1. SOLID WASTE MANAGEMENT UNIT - SWMU SITE: The project is located within the boundary of an identified SWMU site being investigated by the Remediation Group of the NASA Environmental Program Office (#76 - O&C, Mike Deliz, 7-6971, TA-C3). A SWMU designation means a site has had historical operations which may have had the potential to impact the environment. Note: There are areas of known contamination surrounding M7-355, specifically in the southwest side and breezeway separating the wings on the east side. If any excavation will impact these areas as part of the project, contact the abovementioned remediation project manager prior to any soil disturbance or dewatering activity for guidance on proper handling and disposal requirements.

3.a.2. HAZARDOUS/NON-HAZARDOUS WASTE (fluorescent tubes, lighting ballasts, mercury containing devices (thermostats), Freon, etc.): All hazardous and non-hazardous waste generated on KSC must be managed, controlled and disposed of per the KSC Waste Management Requirements outlined in KNPR 8500.1. A Process Waste Questionnaire (PWQ), KSC Form 26-551, must be submitted to the CHS Waste Management office. That office will then generate a Technical Response Package (TRP) which will give direction on proper handling, storage, and disposal of the waste stream. Please contact CHS Waste Management Services at 867-8640 or 867-8642 for assistance.

3.a.3. HAZARDOUS AND CONTROLLED WASTE (PAINT): This project may involve disturbance/removal of paint coatings. The coatings should be sampled and analyzed for PCBs and hazardous metals, to include, lead, cadmium, and chromium. Analysis should be performed by an AIHA certified laboratory. The requirements established in OSHA standards 29 CFR 1926.62 & 29 CFR 1926.1127 for lead and cadmium respectively must be complied with if lead and/or cadmium are present. If heavy metals are present, it is recommended that the control zone and personal protective equipment requirements established in the lead standard be complied with to prevent exposure to workers and adjacent, unprotected personnel. If the coatings are not analyzed for hazardous metals content, they must be treated as if the metals are present and the requirements of the standards must be complied with. All personnel who must utilize respiratory protection must comply with the requirements established in OSHA standard 29 CFR 1910.134 for respiratory protection.

SPECIAL NOTE (HOT WORK ON COATED METAL): Where possible, hot work on painted/coated metal structures should be avoided. If hot work is necessary, affected paint/coating must be sampled for PCBs to determine if additional respiratory protection is required. Degradation of PCBs occur under moderate/extreme thermal conditions (such as torch work) causing PCB materials to degrade into dioxins and other by-product chemicals. Please consult with your organization's Industrial Hygiene representative prior to conducting hot work on any painted/coated surfaces.

3.a.4. HAZARDOUS/NON-HAZARDOUS WASTE (SANDBLASTING): All hazardous waste and non-hazardous wastes generated on KSC during paint removal/sandblasting/surface prep operations must be managed, controlled and disposed of per KNPR 8500.1. All practical precautions must be taken to eliminate the possibility of a release of

## Avoid Verbal Orders

**TO:** **Lockheed Martin Space Systems** **DATE:** **2/22/2007**

**FROM:** **TA-C3/Lead, NEPA Compliance**

**SUBJECT:** **KSC Record of Environmental Consideration (REC)**

materials or waste (primers/paints/blasting debris from the paint surface preparation operations) to the surrounding environment. Please follow the abovementioned PWQ/TRP process when managing these waste streams. Contact CHS Waste Management Services at 867-8640 for assistance.

3.a.5. HAZARDOUS AND CONTROLLED WASTE (ASBESTOS CONTAINING MATERIAL): This is a regulated material that can no longer be used in construction materials. Asbestos was incorporated into many building products and most commonly found in floor tile, roofing materials, caulking compounds, and insulation media. If this project will disrupt construction materials, an asbestos survey should be performed if one has not already been completed. Contact JBOSC Environmental Health at 867-2400 for support. JBOSC Environmental Health has completed a KSC-wide asbestos survey and the data is compiled on the KSC Environmental Health Asbestos Survey Data Home Page (http://amis). If it is known that asbestos exists and will be disturbed, regulations from 62-257 F.A.C. must be followed. Notification to the NASA Environmental Program Branch (TA-C3, 867-1599) is required for any regulated asbestos removal in order that annual reporting requirements are fulfilled. If less than 260 linear feet, or less than 160 square feet of regulated asbestos containing material (RACM) is to be removed, there are no fee or reporting requirements to the FDEP, unless there is demolition of any load-supporting structural member. If the removal trips these thresholds, or is greater than 1 cubic meter, or 35 cubic feet, regulations require a notification to FDEP. The "Notice of Asbestos Renovation or Demolition" (FDEP Form Number 62-257.900(1)) can be found on the FDEP website under "Asbestos Notification" at: http://www.dep.state.fl.us/air/forms.htm. The Permitting and Compliance Group within TA-C3 Environmental Program Office must be copied on all reports submitted to FDEP. For asbestos disposal, CHS Waste Management can supply direction on proper handling, storage, and disposal though the PWQ/TRP process. Please contact CHS Waste Management Services at 867-8642 for assistance.

3.a.6. HAZARDOUS AND CONTROLLED WASTE (POLYCHLORINATED BIPHENYLS): There is a potential for this project to encounter PCB contaminated materials/waste (caulking, transformers, concrete transformer pad, etc.). If PCB content is unknown, sampling must be performed. See KNPR 8500.1 Rev. A, Chapter 20 for PCB management guidelines. In addition to window caulking and electrical equipment, transformer concrete pads and other surrounding materials may contain PCB contamination. To determine if surrounding media and/or surfaces to be disturbed/disposed of have been contaminated with oils containing polychlorinated biphenyls by past actions contact CHS Waste Management. They will determine the applicable regulatory requirements and guidance for the proper management of the waste PCB materials. Please follow the PWQ/TRP process for waste disposal. Contact CHS Waste Management Services at 867-8642 for assistance.

3.a.7. AIR EMISSIONS (PAINT VOCs): Based on the coatings to be applied, this project may emit Volatile Organic Compounds (VOCs) and Hazardous Air Pollutants (HAPs) during painting operations. The emissions are fugitive in nature and no air permitting is required. Fugitives from an activity such as this are not required to be reported to the Florida Department of Environmental Protection; therefore, no further information is needed for the Air Section of the Permitting and Compliance Group. Contact the NASA Permitting and Compliance Office (TA-C3, 867-1599) if you have any questions.

3.a.8. HISTORIC PROPERTY: The O&C building is listed as historic property on KSC. Historic property has been removed from the O&C High Bay and consultation with the State Historical Preservation Officer (SHPO) has been completed. If modifications are planned for either of the two altitude chambers, a separate environmental checklist should be submitted and additional review by the SHPO will be required. Questions related to this subject should be forwarded to the NASA Environmental Program Office (Mario Busacca, TA-C3, 7-8456).

3.a.9. DEWATERING: Dewatering effluent may be discharged to grade. Dewatering must be conducted in accordance with the "Noticed General Permit for Short Term Construction Dewatering" Permit # 84324 issued by the St. Johns River Water Management District. At least three weeks prior to the beginning of dewatering, the initiating organization must submit the data described in Condition 10 of the permit to the NASA Environmental Program Branch (TA-C3). If the dewatering will be 300,000 gallons per day or less and will not exceed 30 days duration, then the submittal of the data is not required, however, the dewatering activity must comply with all other conditions of the permit. Note: All waters discharged to grade must not enter existing surface waters. Effluent must be discharged to a pervious surface to facilitate infiltration back into the ground. Contact Doug Durham (867-8429) for further assistance if required.

3.a.10. RADIATION: This project may involve the generation of a radiation source which must be evaluated by the

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**SUBJECT:** **KSC Record of Environmental Consideration (REC)**

Comprehensive Health Services (CHS) Health Physics Group. A KSC Radiation Use Form (KSC Form 16-451) must be completed and submitted to the NASA TA-C office. The source of the radiation will be evaluated for possible hazards and a use authorization or exemption will be issued. If you have any questions contact Rob Bullock, CHS, at 853-5609.

3.a.11. RECYCLING: The contractor must make every practical effort to reclaim and segregate materials that have the ability to be easily recycled as per KNPR 8500.1. In addition, all reclaimed concrete must be segregated from other wastes and transported to the KSC Landfill (L7-0071) on Schwartz road. For any other information regarding what materials can be recycled or other general information regarding recycling policies at KSC, please contact the NASA Environmental Program Office (Alice Smith, 867-8454 or Maggie Forbes, 867-3305).

3.a.12. AFFIRMATIVE PROCUREMENT (AP): Federal agencies and their contractors are required to purchase products made from recycled or recovered materials whenever possible. Detailed information on EPA approved products is availabe at www.epa.gov/cpg/products.htm. A Request for Waiver Form (KSC 28-825 NS) must be submitted for the purchase of items that are on the Comprehensive Procurement Guidelines (CPG) list but were replaced with non AP approved items. Contact Alice Smith (867-8454) with any questions on this requirement.

3.b.1. EXCAVATION PERMIT: An Excavation Permit will be required for any digging proposed by this project. Please contact Mission Support at 861-4453 for an underground utility scan.

3.b.2. WATER RESOURCE PERMITTING: Potable Water/Domestic Wastewater - If modifications are interior to the building envelope, no permit is required. Although no permit is specifically required, any work done will be per standards and criteria that would have been required had there been a permit issued by the Department and, not jeopardize the health and safety of personnel due to effects of the construction/modification on the KSC potable water system (i.e. backflow preventers will be installed as required per KSC-STD-Z-0013 and standard engineering practice). The organization responsible for the work will ensure that best engineering practices, codes, specifications and standards are followed. Pressure and leak tests as well as disinfection are also required. If modifications are being considered outside the building (introduction of larger pipes or replacement of existing pipes) a permit will be required. Contact Doug Durham (867-8429) for further assistance.

No other environmental issues were identified based upon the information provided in the KSC Checklist. This Record of Environmental Consideration (REC) does not relinquish the project lead from obtaining and complying with any other internal NASA permits or directives necessary to ensure all organizations potentially impacted by this project are notified and concur with the proposed project.

Due to potential changes in regulations, permit requirements and environmental conditions, statements in this REC are valid for 6 months, and subject to review after this period. The Environmental Program Branch (EPB) will be reviewing open projects twice a year for possible impacts from changes in contaminated sites. If impacts are foreseen, EPB will notify the project lead with a new REC. It is the responsibility of the project lead to notify EPB if the scope of the project (including the design) has changed since the original checklist was submitted.

cc: M. Sisler/Lockheed Martin
M. Busacca/TA-C3

**4 Upon evaluation of the subject project, the above determinations have been made and identified. Contact the Environmental Program Office (TA-C3) at 867-8456 for re-evaluation should there be any modifications to the scope of work.**

K. Manguikian

**2/22/2007 3:42:03 PM**

**Kim Manguikian** **Date**

Appendix 1D. Categorical exclusion documentation for Hangar AF, KSC, Florida.

## Avoid Verbal Orders

**TO:** DX-D1/Environmental Coordinator **DATE:** 1/8/2007

**FROM:** TA-C3/Lead, NEPA Compliance

**SUBJECT:** KSC Record of Environmental Consideration (REC)

**1. PROJECT INFORMATION**

**Project Title:** Modifications and Upgrades to Hangar AF, CCAFS

**Project Lead:** Phil Bennardo, DX-B2, 867-4553 **Directorate Project No.:** 98620

**EPO Reviewer:** LPH **Environmental (ENV) No.:** N/A

**2. NEPA DETERMINATIONS**

- ☑ **a. Categorical Exclusion per 14 CFR Part 1216.305(d)**
- ☐ **b. Environmental Assessment (EA) Required per KHB 8800.6**
- ☐ **c. Environmental Impact Statement (EIS) Required per KHB 8800.6**
- ☐ **d. Project on CCAFS:**

**3. ENVIRONMENTAL REQUIREMENTS**

| | | |
|---|---|---|
| **a. Non-Permit Requirements** | ☑ **YES** | ☐ **NO** |
| **b. Permit Requirements** | ☑ **YES** | ☐ **NO** |

**********ORIGINAL REC ISSUED 9/20/2006 LPH**********
**********UPDATED 1/8/2007 CATEX, SWMU, AF COORDINATION**********

The NASA Environmental Program Branch (EPB) has assigned John Shaffer, TA-C3, 867-8448 as the Environmental Point Of Contact (EPOC) for this project. Please add Mr. Shaffer's name to any lists or notifications of meetings related to this project. All questions relating to environmental issues should be forwarded to the EPOC section within the NASA EPB (John Shaffer, TA-C3, 7-8448).

PROJECT DEVELOPMENT: This Record of Environmental Consideration (REC) Process is not complete at this time. Due to the possible variations in design and scope of this project, the NASA Environmental Program Branch (TA-C3) will revise this response at a later date when more information is available relating to the possible environmental impacts. It is the project proponent's responsibility to ensure that meeting notification to the EPB EPOC is provided. As more detailed information is provided for the proposed four phases of this project, the REC will be updated and individual RECs may be developed for the various phases.

AF FORM 813: This project is located on CCAFS property. Coordination with the 45th CES/CEVP is required. AF Form 813 must be completed for project review by the Air Force. Contact (A. Chambers, 853-6822, 45 CES/CEVP) if clarification is required.

2.a.1. CATEGORICAL EXCLUSION (CATEX): Upon further review, this office has determined that the project qualifies for a Categorical Exclusion (CATEX) under federal regulations (14 CFR 1216.305(d)). For additional information, please contact Mario Busacca of the NASA Environmental Program Branch (867-8456).

3.a.1 SOLID WASTE MANAGEMENT UNIT - SWMU SITES: This project is located within the boundaries of an identified SWMU site being investigated by the Air Force (Hangar AF, AF SWMU #58). A SWMU designation means a site has had historical operations which had the potential to impact the environment. There may be special requirements for handling soil and/or groundwater in the project area. Coordinate site activities with Mark Kershner, 321-467-0964.

3.a.2. HAZARDOUS AND CONTROLLED WASTE (ASBESTOS CONTAINING MATERIAL): This is a regulated material that can no longer be used in construction materials. Asbestos was incorporated into many building products and most commonly found in floor tiles, roofing materials, caulking compounds, and insulation media. If this project will disrupt construction materials, an asbestos survey should be performed if one has not already been completed. Contact JBOSC Environmental Health at 867-2400 for support. JBOSC Environmental Health has completed a KSC-wide asbestos survey and the data is compiled on the KSC Environmental Health Asbestos Survey Data Home Page at http://amis. If it is known that asbestos exists and will be disturbed, regulations from 62-257 F.A.C. must be followed

## Avoid Verbal Orders

**TO:** DX-D1/Environmental Coordinator **DATE:** 1/8/2007

**FROM:** TA-C3/Lead, NEPA Compliance

**SUBJECT:** KSC Record of Environmental Consideration (REC)

and notification to the NASA Environmental Program Office (TA-C3, 867-8428) is required. If less than 260 linear feet, or less than 160 square feet of regulated asbestos containing material (RACM) is to be removed, there are no fee or reporting requirements to the FDEP, unless there is demolition of any load-supporting structural member. If the removal trips these thresholds, or is greater than 1 cubic meter, or 35 cubic feet, regulations require notification to FDEP. The "Notice of Asbestos Renovation or Demolition" (DEP Form Number 62-257.900(1)) can be found on the FDEP website under "Asbestos Notification" at: http://www.dep.state.fl.us/air/forms.htm. The Permitting and Compliance Group within TA-C3 Environmental Program Office must be copied on all reports submitted to FDEP. For asbestos disposal, SGS Waste Management can supply directions on proper handling, storage, and disposal of the waste stream though the Process Waste Questionnaire / Technical Response Package (PWQ/TRP) process. Please contact SGS Waste Management Services at 867-8642 for assistance.

3.a.3. HAZARDOUS AND CONTROLLED WASTE (PAINT): This project may involve disturbance/removal of paint coatings. Unless known to be non-hazardous, the coatings should be sampled and analyzed for PCBs and the 8 RCRA hazardous metals (Ag, As, Ba, Cd, Cr, Hg, Pb, and Se). Analysis should be performed by an AIHA certified laboratory. The requirements established in OSHA standards 29 CFR 1926.62 & 29 CFR 1926.1127 for lead and cadmium respectively must be complied with if lead and/or cadmium are present. If the coatings contain heavy metals, it is recommended that the control zone and personal protective equipment requirements established in the lead standard be complied with to prevent exposure to workers and adjacent unprotected areas. The sampling analysis will dictate the level of PPE required and the handling/disposal requirements. All practical precautions must be taken to eliminate the possibility of a release of material or waste into the environment (primers/ paints/ blasting debris from the paint surface preparation operations/other). If you have questions about PPE requirements call John Sherwood, CHS-022, at 7-1210.

3.a.4. HAZARDOUS/NON-HAZARDOUS WASTE: All hazardous waste and non-hazardous wastes generated on KSC must be managed, controlled and disposed of per the KSC Waste Management requirements outlined in KNPR 8500.1. A Process Waste Questionnaire (PWQ), KSC Form 26-551 along with any supporting documentation (MSDS, product formulation) must be submitted to the CHS Waste Management Office for each waste stream generated. That office will then generate a Technical Response Package (TRP) which will give you direction on proper handling, storage, and disposal of the waste stream. Please contact CHS Waste Management Services at 867-8640 if assistance is required.

3.a.5. DEWATERING: Dewatering effluent may be discharged to grade. Dewatering must be conducted in accordance with the "Noticed General Permit for Short Term Construction Dewatering" Permit # 84324 issued by the St. Johns River Water Management District. At least three weeks prior to the beginning of dewatering, the initiating organization must submit the data described in Condition 10 of the permit to the NASA Environmental Program Branch (TA-C3). If the dewatering will be 300,000 gallons per day or less and will not exceed 30 days duration, then the submittal of the data is not required, however, the dewatering activity must comply with all other conditions of the permit. All waters discharged to grade must not enter existing surface waters. Effluent must be discharged to a pervious surface to facilitate infiltration back into the ground. Contact Doug Durham (867-8429) for further assistance if required.

3.a.6. THREATENED AND ENDANGERED SPECIES: This project will have the potential to impact T&E species, in particular, the manatee and the Least Tern. This project will require contract conditions that detail plans to avoid contact or impact to the manatee during construction activities to modify the slip or wharf. The NASA EPB office requires the establishment of a "Manatee Awareness/Protection Plan" during any operation which may impact surface waters of the Banana River. This plan will include a requirement that all vessels operate at idle speed and clearly display manatee awareness placards. The contractor will post temporary signs designating the area as manatee habitat. All work must be halted when manatee are within 50' feet of operations. Clarification of these requirements can be obtained through the NASA Environmental Program Branch (John Shaffer, TA-C3, 7-8448).
The threatened Least Tern is known to nest on rooftops. The roof on Hangar AF is a built-up roof which is the type of roof that the terns tend to nest on especially if gravel is present. Nesting season occurs from Late April through July. Prior to any roof work associated with this project, a biological survey of the roof must be performed. Least Terns do not construct typical nests. They use the existing contours of the roof structures (anyplace the stone covering has been disturbed i.e. footprint), making the identification of eggs very difficult. The NASA Environmental Program Office will schedule a biological survey upon request or answer any questions. Contact John Shaffer at 867-8448. Please allow 10 working days prior to project commencement for survey scheduling.

3.b.1. ENVIRONMENTAL RESOURCE PERMIT (ERP): This project will require a separate ERP for a storm water

## Avoid Verbal Orders

**TO:** DX-D1/Environmental Coordinator **DATE:** 1/8/2007

**FROM:** TA-C3/Lead, NEPA Compliance

**SUBJECT:** KSC Record of Environmental Consideration (REC)

treatment system if the entire impervious surface to be added exceeds 9,000 square feet as outlined in Chapter 40C-4 FAC. The applications should be completed by the 90% Design Review phase and seven copies of the application and one electronic version in PDF format should be submitted to Doug Durham, NASA EPB (TA-C3). Contact Doug Durham at 867-8429.

3.b.2. DREDGE AND FILL PERMIT: Dredge and fill permits from SJRWMD (ERP) and ACOE may be required for this project. Five copies of the application form with supporting material such as maps and engineering drawings, must be submitted to the NASA EPB (John Shaffer, TA-C3) by the 90% Design Review phase for distribution to the regulatory agencies. An electronic version in PDF format should also be provided. Please contact John Shaffer at 867-8448, for assistance in preparing this application. Once all the information has been gathered, NASA EPB will submit the permit request. No work can be performed until the permit process is completed.

3.b.3. EXCAVATION PERMIT: A KSC Excavation Permit will be required for any digging proposed by this project. Please contact Mission Support at 861-4453 for an underground utility scan.

3.b.4. OTHER PERMITS: Additional permit requirements (eg. Domestic/Industrial Wastewater, Drinking/FIREX Water, and Air Emissions) will be determined upon receipt of additional information and project details.

No other environmental issues were identified based upon the information provided in the KSC Checklist. This Record of Environmental Consideration (REC) does not relinquish the project lead from obtaining and complying with any other internal NASA permits or directives necessary to ensure all organizations potentially impacted by this project are notified and concur with the proposed project.

Due to potential changes in regulations, permit requirements and environmental conditions, statements in this REC are valid for 6 months, and subject to review after this period. The Environmental Program Branch (EPB) will be reviewing open projects twice a year for possible impacts from changes in contaminated sites. If impacts are foreseen, EPB will notify the project lead with a new REC. It is the responsibility of the project lead to notify EPB if the scope of the project (including the design) has changed since the original checklist was submitted.

cc: P. Bennardo/DX-B2
A. Chambers/45 CES/CEV
M. Busacca/TA-C3
J. Shaffer/TA-C3

**4 Upon evaluation of the subject project, the above determinations have been made and identified. Contact the Environmental Program Office (TA-C3) at 867-8456 for re-evaluation should there be any modifications to the scope of work.**

K. Manguikian

**1/9/2007 7:41:49 AM**

**Kim Manguikian** **Date**

Appendix 2. KSC land cover types and areas.

| Cover Type | KSC+MINWR Area (ha/ac.) |
|---|---|
| Infrastructure - primary | 533.5 / 1,318.2 |
| Infrastructure - secondary | 202.3 / 499.9 |
| Estuary | 12,157.0 / 30,040.7 |
| Water - interior - salt | 2,559.4 / 6,324.4 |
| Water - interior - fresh | 359.2 / 887.5 |
| Barren land - may be inundated | 75.6 / 186.9 |
| Beach | 26.1 / 64.6 |
| Ditch | 126.6 / 312.9 |
| Marsh - saltwater | 3,880.0 / 9,587.7 |
| Marsh - freshwater | 2,247.5 / 5,553.7 |
| Mangrove | 518.2 / 1,280.5 |
| Wetland scrub-shrub - saltwater | 636.3 / 1,572.4 |
| Wetland scrub-shrub - freshwater | 1,944.6 / 4,805.3 |
| Wetland coniferous / hardwood forest | 611.6 / 1,511.2 |
| Wetland hardwood forest | 406.2 / 1,003.9 |
| Ruderal - herbaceous | 1,382.6 / 3,416.5 |
| Citrus | 705.5 / 1,743.3 |
| Ruderal - woody | 461.5 / 1,140.3 |
| Australian pine | 32.6 / 80.5 |
| Coastal strand | 135.8 / 335.5 |
| Oak scrub | 4,990.2 / 12,331.2 |
| Palmetto scrub | 1,101.4 / 2,721.5 |
| Pine flatwoods | 920.0 / 2,273.5 |
| Upland coniferous forest | 72.7 / 179.6 |
| Modified from Schaub 2005 | |

Appendix 3. Noise levels (in decibels, A-weighted) measured on KSC, Florida.

| | | DISTANCE FROM SOURCE [a] | | | |
|---|---|---|---|---|---|
| **SOURCE** | **NOISE LEVEL (Peak)** | **15 m (50 ft.)** | **30 m (100 ft.)** | **60 m (200 ft.)** | **120 m (400 ft.)** |
| **Construction** | | | | | |
| Heavy Trucks | 95 | 84-89 | 78-83 | 72-77 | 66-71 |
| Pickup Trucks | 92 | 72 | 66 | 60 | 54 |
| Dump Trucks | 108 | 88 | 82 | 76 | 70 |
| Concrete Mixer | 105 | 85 | 79 | 73 | 67 |
| Jackhammer | 108 | 88 | 82 | 76 | 70 |
| Scraper | 93 | 80-89 | 74-82 | 68-77 | 60-71 |
| Dozer | 107 | 87-102 | 81-96 | 75-90 | 69-84 |
| Paver | 109 | 80-89 | 74-83 | 68-77 | 60-71 |
| Generator | 96 | 76 | 70 | 64 | 58 |
| Shovel | 111 | 91 | 85 | 79 | 73 |
| Crane | 104 | 75-88 | 69-82 | 63-76 | 55-70 |
| Loader | 104 | 73-86 | 67-80 | 61-74 | 55-68 |
| Grader | 108 | 88-91 | 82-85 | 76-79 | 70-73 |
| Caterpillar | 103 | 88 | 82 | 76 | 70 |
| Dragline | 105 | 85 | 79 | 73 | 67 |
| Shovel | 110 | 91-107 | 85-101 | 79-95 | 73-95 |
| Dredging | 89 | 79 | 73 | 66 | 77 |
| Pile Driver | 105 | 95 | 89 | 83 | 77 |
| Ditcher | 104 | 99 | 93 | 87 | 81 |
| Fork Lift | 100 | 95 | 89 | 83 | 77 |
| **Vehicles** | | | | | |
| Diesel Train | 98 | 80-88 | 74-82 | 68-76 | 62-70 |
| Mack Truck | 91 | 84 | 78 | 72 | 66 |
| Bus | 97 | 82 | 76 | 70 | 54 |
| Compact Auto | 90 | 75-80 | 69-74 | 63-68 | 57-62 |
| Passenger Auto | 85 | 69-76 | 63-70 | 57-64 | 51-68 |
| Motorcycle | 110 | 82 | 76 | 70 | 64 |
| [a] Assume 6 dBA decrease for every doubling of distance.<br>Modified from Suter 2002 | | | | | |

Appendix 4. Letter to the Florida State Historic Preservation Office, November 2006.

National Aeronautics and
Space Administration
**John F. Kennedy Space Center**
Kennedy Space Center, FL 32899


TA-C3

November 27, 2006

Reply to Attn of:

Mr. Fred Gaske
Director, State Historic Preservation Office
Division of Historical Resources
Department of State
R. A. Gray Building
500 S. Bronough Street
Tallahassee, FL 32399-0250

Subject: Consideration of Modifications in Support of the Constellation Program at the John F. Kennedy Space Center

President George W. Bush announced a new policy for space exploration with the goal of landing humans on the Moon before the end of the next decade, paving the way for eventual human journeys to other destinations in his January 14 address to the Nation. In pursuing this new policy, NASA has been tasked with developing the spacecraft, launch vehicles and related technologies necessary to travel and explore the Solar System. An Environmental Assessment (EA) was prepared in August 2006 with a Finding of No Significant Impact for the *Development of the Crew Exploration Vehicle* to support NASA's decision-making process. A Programmatic Environmental Impact Statement (EIS) is being prepared for the implementation and design of the *Constellation Program*. Major elements of the Program are currently focused on providing the capability to transport crew and cargo to the moon, in support of lunar exploration missions, and to the International Space Station (ISS). These activities would provide the framework for future human exploration of Mars and other destinations in the Solar System in the decades to come.

NASA has several projects and activities that must be started in the very near future; that is, prior to the completion of the Programmatic EIS. These activities are either long-lead items or are modification in existing facilities needed to support of the first proposed test flight of the Constellation Crew Launch Vehicle, the Ares I-1 which is currently targeted for late 2009. Therefore, to comply with NEPA, NASA KSC is preparing an EA in support of these modifications. The facilities impacted are the Vehicle Assembly Building (VAB), Mobile Launcher Platform-1 (MLP-1), Launch Complex 39B, and Hangar AF Solid Rocket Booster Slip. The first three are listed as historical properties under the Apollo Program while the last is likely to be considered eligible for listing as related to the Space Shuttle Program. The modifications of each facility are described below:

***Vehicle Assembly Building (VAB)*** - The VAB modifications proposed are considered very minor. NASA is in the process of assessing a potential interference between the Ares I vehicle and the High Bay upper most platform ("C") track girder. The resolution to the interference is not yet finalized; however, a conservative approach would be to remove the "C" platform in its entirety for the test flights and the platform would then either be replaced or left out and modified for future flights. In summary, there will potentially be some minor modifications to on or more platforms in the VAB, but these will not change the function or overall appearance of the Facility.

***Mobile Launcher Platform-1 (MLP-1)*** – The modifications proposed for the MLP-1 will be to: (1) Add exhaust hole covers to the Space Shuttle Main Engine and the right hand Solid Rocket Booster exhaust holes; (2) add a damper structure to reduce motion of the vehicle during transfer to the pad and while at the pad; and (3) and some electrical control modifications interior to the MLP. These modifications will not change the functions of the MLP and while it may look somewhat different with the exhaust one covered, these modifications as reversible.

***Pad B*** – The modifications proposed for Pad B are modifying the three existing arms on the Fixed Service Structure (FSS): (1) The ET GH2 arm for access to the XL segment; (2) the GOX vent arm for access to the Interstage area of the vehicle and for loading hypergols; and (3) the Orbiter access arm for access to the forward skirt. Also proposed is the addition of an Environmental Control System T-0 umbilical from the FSS. These modifications are all minor in nature largely involving adding piping and cabling. An additional modification that may occur is the addition of an access structure to the top of the Rotating Service Structure (RSS) to provide access to the XL segment, the Interstage of the new launch vehicle, and the forward skirt of the vehicle. All of these modifications are considered minor in nature and would not change the overall function or look of the Launch Complex.

***Hangar AF Solid Rocket Booster Slip*** – This slip is used for retrieval of the four segment solid Rocket Booster currently used for the Space Shuttle. The new vehicles for the Constellation Program will use five segment boosters. Therefore NASA is studying the need to extend the slip to accommodate the increased length of the boosters. This extension could be either into the water and/or land. Either modification would change the look of the slip slightly but not change its function.

Based on the proposed modifications being proposed to support the early portion of the Constellation Program, NASA has determined that their implementation would not constitute an "adverse effect" on these Historic Properties. This determination is based on several factors.

- The VAB has four high bays and only one high bay will be used for the test flight(s) with minor modifications. The other bays will continue to process the Shuttle. In addition, the proposed modifications would not impact the form or function of the facility.

- NASA has three MLPs and two Shuttle launch pads. Only one (MLP-1 and Pad B) are being proposed with minor changes. The other two MLPs and Pad A will continue to support the Shuttle Program.

- Previously modifications have been made to the VAB, MLPs, and the Pads from their original configurations to support Space Shuttle launches. While the changes changed the form of these facilities in that there were different components used, the basic function, that of launch processing has remained the same. As an operational facility, frequent changes are made over the course of time, additions and modifications have been made as operational requirements have changed and new technologies have been introduced.

We hereby request your concurrence to proceed. Please note that we do expect to have additional, more extensive modifications to these and other facilities on KSC to support the Constellation Program. These additional activities will be addressed under the Programmatic EIS and under a separate consultation with your office.

If you have any questions or require further assistance, please contact Mr. Mario Busacca in the Environmental Program Office at (321) 867-8456.

Mario Busacca
KSC Historic Preservation Officer

cc:
NASA HQS/JE/Ken Kumor
CC/Tracy Lee Belford

CONCURRENCE:

_____ _____
Fred Gaske Date
Florida State Historic Preservation Officer

Appendix 5. Memorandum of Record: Proposed mitigations for Lightning Protection System, LC 39B, KSC, Florida.

January 23, 2007

MEMORANDUM FOR RECORD

FROM: TA-D1/Lead Design Engineer

SUBJECT: Potential Mitigation Strategies and Findings for PCN 98558: Construct Lightning Protection System, LC-39B

This project involves the design and construction of a lightning protection system at Pad LC 39B to protect the launch vehicle and associated launch equipment from direct lightning strikes during launch processing and other activities prior to flight. The system is currently proposed to consist of overhead catenary wires and down conductors supported by three 605 foot steel/fiberglass towers.

As part of the design process, the NASA design team and Architectural-Engineering Firm under government contract for the design were asked to analyze multiple mitigation strategies to minimize the impact of this design to the environment. According to the NASA Environmental Branch, the proposed Lightning Protection System (LPS) towers and associated wires and lights have the potential to negatively affect birds, bats, and sea turtles that utilize the areas surrounding LC 39B. Many species have federal regulatory protection under the Endangered Species Act and the Migratory Bird Treaty Act. Birds and bats could be injured or killed via collisions with the LPS towers and wires. Sea turtles may become disoriented due to associated light pollution on adjacent beaches.

This memorandum outlines each of the mitigation strategies which were recommended by the NASA Environmental Program Branch in an effort to reduce the negative impacts of the LPS on affected wildlife species and details which recommendations were successfully implemented and provides reasons for those recommendations that could not be successfully implemented.

**WILDLIFE IMPACT: Birds/Sea Turtles**
**MITIGATION STRATEGY: Lighting Minimizations**

**Recommendation:** The minimum amount of pilot warning and obstruction avoidance lighting required by the FAA should be used.

**Disposition:** Multiple coordination meetings were held with the KSC Aviation Safety Branch and the NASA Environmental Program Branch to discuss the options for minimizing FAA lighting in an effort to implement this mitigation strategy. The KSC Aviation Safety Branch adheres to the FAA Advisory Circulars in the area of approved Obstruction Lighting (FAA Order 7400.2F and Aeronautical Information Manual, Official Guide to Basic Flight Information and ATC Procedures). These regulations dictate the number and position of obstruction lights. Based on these regulations we have incorporated a design

that minimizes the number of FAA lights. Based on the tower heights, we have been able to limit the number of lights to two levels with three lights per level. In addition, we have minimized the number of lights necessary to provide illumination of the structural fiberglass portion. In summary, the minimum amount of obstruction lighting required will be used.

**WILDLIFE IMPACT: Birds**
**MITIGATION STRATEGY: Lighting Minimizations**

**Recommendation:** Unless otherwise required by the FAA or the KSC Aviation Office, only white (preferable) or red strobe lights should be used at night, and these should be the minimum number, minimum intensity, and minimum number of flashes per minute (longest duration between flashes) allowable by the FAA.

**Disposition:** The FAA regulations and KSC Aviation Safety Branch provide multiple alternatives for lighting --- including red lighting, white lighting, steady lighting, and flashing lighting. Based on the recommendations of the Environmental Program Branch, the white flashing light set-up was chosen. This is based on the FAA requirement that red lighting be steady at night --- which would cause issues with migratory bird collisions. For night-time flashing applications of white lights, the FAA regulations allow for a either 60 flashes per minute or 40 flashes per minute. In an effort to meet this mitigation strategy, a Type L-856 light will be used which illuminates at 40 flashes per minute.

**WILDLIFE IMPACT: Birds**
**MITIGATION STRATEGY: Wire/Collision Mitigation**

**Recommendation:** Reduce the number of vertical structures used in the design and reduce the height of these structures to reduce the probability of migratory bird strikes.

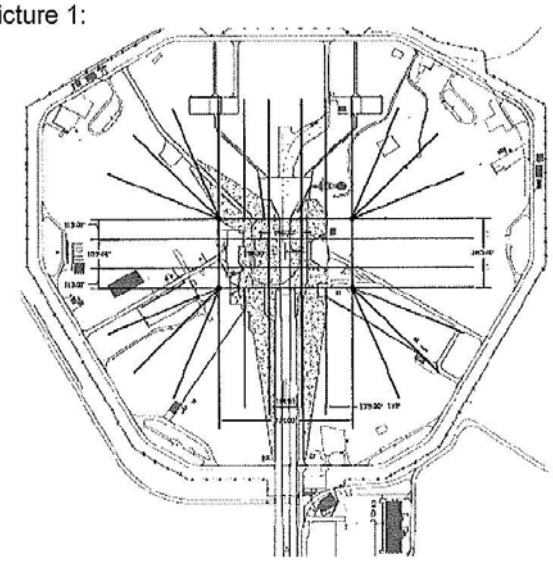
**Disposition:** The original design concept called for a system similar to Launch Pad 41 – with four supporting towers. Additionally, early concepts also considered designs with square bases and four upright legs per tower. Based on various design considerations and based on this recommendation, options were considered to reduce not only the number of upright legs per tower, but also eliminate one or more of the towers. Through an iterative design process, the number of towers was reduced from 4 to 3. An attempt was made to reduce the number of towers to two, but the effectiveness of the system against possible strikes was compromised. In addition, the original concept for the towers was based on a nominal height of 668 feet. Through an iterative design process the heights were reduced to a final estimated height of 605 feet. These steps greatly reduced the overall vertical structures to be constructed.

**WILDLIFE IMPACT: Birds**
**MITIGATION STRATEGY: Wire/Collision Mitigation**

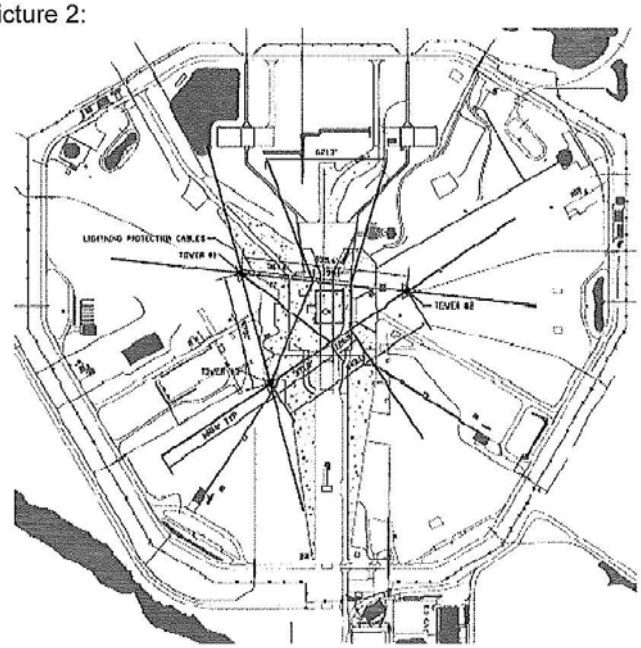
**Recommendation:** The greater the number of wires, the more risk of bird strikes. Therefore, reduce or eliminate wires where possible. Incorporate grounding wires into the towers, or if that is not feasible, use minimum tower-to-wire angle permissible.

**Disposition:** Several steps have been taken during the design process to meet this mitigation goal. The initial concept for the protection system (see Picture 1) included nearly 48 catenary wires and down conductors as well as four towers. Through multiple iterations of engineering calculations and lightning strike analysis the design was able to be reduced to a system that includes only three towers and only 14 catenaries and down conductors (see Picture 2). Options were explored to address the concept of incorporating the grounding wires into the towers as well as minimizing the tower-to-wire angles. It was found to be infeasible to route the grounding wires through the tower. The concept of the protection system involves preventing direct strikes to the vehicle and associated launch equipment. This includes instrumentation and communication equipment located on the towers. Routing the grounding wires through the towers will increase the probability of damage to such equipment The angles between the down conductors and the towers were examined and were reduced to a distance that is minimally required to structurally support the overhead catenaries and prevent flashover of lightning currents from the downleads to the steel portions of the towers. Any further decrease in the tower-to-wire angle would create an increased risk of flashover – thereby increasing the risk lightning damage to equipment installed on the towers.

Picture 1:



Picture 2:




**WILDLIFE IMPACT: Birds**
**MITIGATION STRATEGY: Wire/Collision Mitigation**

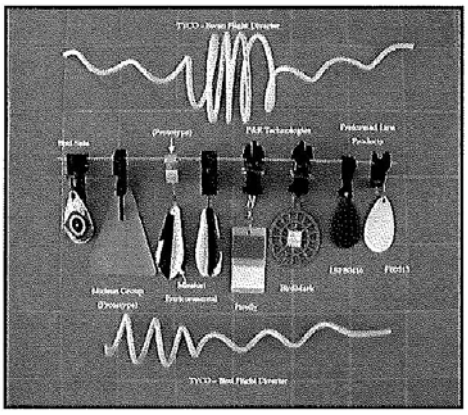
**Recommendation:** Use maximum diameter wire permissible for increased visibility.

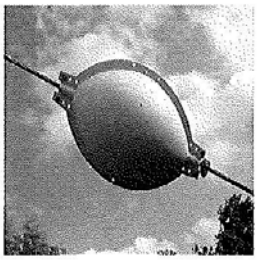
**Disposition:** The proposed overhead catenary wires are 1 inch in diameter with the proposed crossing overhead catenary wires being 3/4 inches in diameter. The proposed tower down conductors are 1.25 inches in diameter and the catenary down conductors are 5/8 inches in diameter. These diameters are the largest reasonable sizes that can still be structurally supported by the towers and connections.

**WILDLIFE IMPACT: Birds**
**MITIGATION STRATEGY: Wire/Collision Mitigation**

**Recommendation:** Tower design should incorporate daytime visual markers (e.g., bird diverter devices) on wires to prevent collisions by diurnally active species. Picture 3 shows examples of bird flight diverters that are commercially available.

Picture 3:





**Disposition:** Some daytime visual markers will be incorporated into the lightning protection system to help prevent bird collisions. These visual markers will be required to be large, non-conductive, and easily inspected. The current design calls for daytime visual markers on each of the down conductors to make them more visible for diurnal birds. Research was done to determine whether the visual markers could be used on the overhead catenaries as well. One of the major concerns was that we were unable to find any such devices that were tested for conditions that would be experienced in a launch type of environment – exposed to an extremely corrosive, high temperature, dynamic environment. Also, we have been unsuccessful in finding any examples of their use on catenary wire systems that may experience extreme current loads. Additionally, it is unknown whether these additions to the catenary wires would have any overall effect on the actual effectiveness of the system, since there is no data available. The other concern is the FOD potential created by the use of these diverters. Since their capabilities are un-tested on the application we are considering, there is a potential for FOD. Based on these findings, the daytime visual markers will not be incorporated into the overhead catenaries, but will used on the down conductors where feasible.

**WILDLIFE IMPACT: Sea Turtles**
**MITIGATION STRATEGY: Wire/Collision Mitigation**

**Recommendation:** Light pollution caused by the LC 39B launch complex and associated LPS is the most critical factor that could aversely affect sea turtles. Artificial lighting near beaches has been shown to disrupt female nesting behavior and causes disorientation in hatchling turtles (Witherington and Martin 1996). The "KSC Exterior Lighting Guidelines Plan" (NASA/USFWS 2006) is the

standard document used to implement appropriate lighting. A summary of lighting mitigation strategies proposed by the Florida Marine Research Institute (Witherington and Martin 1996) and NASA/USFWS (2006) includes:

- Dim/eliminate lights wherever possible.
- Direct lights away from the beach.
- Use long-wave light sources when possible (these need to be coordinated in conjunction with impacts to birds).
- Do not use up-lighting.
- Implement habitat modification designed to shield the beach from light (dune restoration, planting vegetation, etc.).

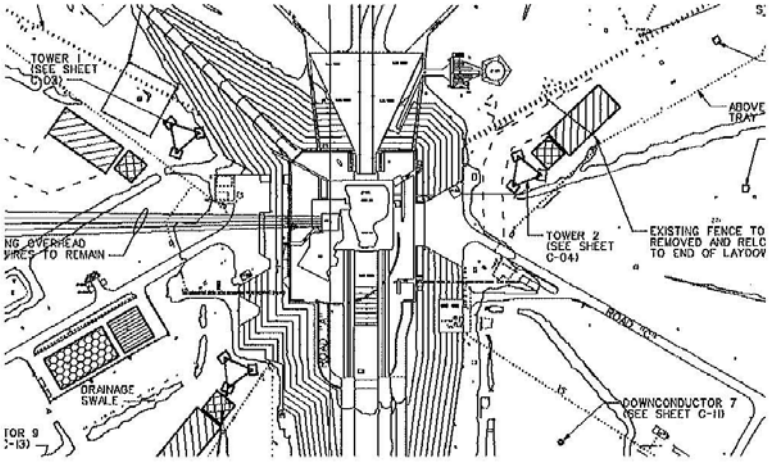
**Disposition:** Through design modifications and operational constraints the LPS design will minimize all lighting so that the only lighting will be the minimal as required by the FAA. Where possible and practical, lights will be shielded from and directed away from the beach. The light sources will be the longest wave light available per the FAA specifications and up-lights will be eliminated except for on the mast. The mast uplighting is required since beacons cannot be used on the mast for reasons described subsequently in this memorandum. All task lighting will be the minimal as required per NFPA and will be switch activated only with timers to prevent the lights from being left on when not in use.

**WILDLIFE IMPACT: Sea Turtles**
**MITIGATION STRATEGY: Lighting Minimizations**

**Recommendation:** Orient the towers so that only one leg of the triangle is pointing toward the beach.

**Disposition:** This can and will be accomplished. The towers will be oriented so that one leg of each triangular tower faces the ocean (east). See Picture 4.

Picture 4:

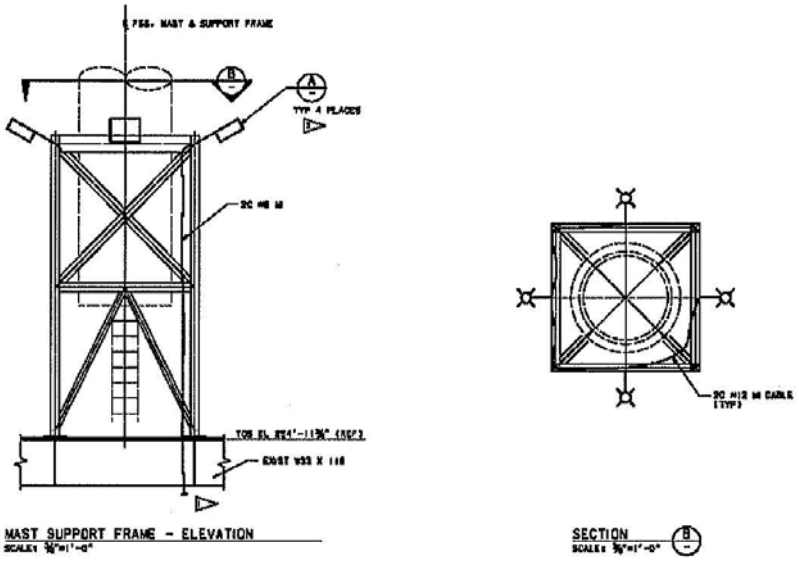



**WILDLIFE IMPACT: Sea Turtles**
**MITIGATION STRATEGY: Lighting Minimizations**

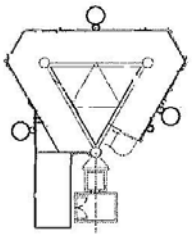
**Recommendation:** Use a single flashing light on top of the mast vs. floodlights to illuminate the mast.

**Disposition:** This cannot be accomplished due to the insulating nature of the mast that must be maintained in order to avoid currents from flowing down the towers. A light on the top of the mast cannot be entirely isolated from the metallic portion of the tower. Even if all non-conductive fasteners and housings are used, the light will require electrical connection to the power sources fed through the main tower structure. In the event of a lightning strike there is no way to prevent current from flowing through this connection. This current, when carried through the tower could cause additional damage to mounted cameras, sensors, and equipment. In addition, the system is designed to prevent current flow through the tower. The existing mast at LC-39B is uplighted by four lights. The current design calls for a reduction in this number of lights for only two uplights. See Picture 5 & 6.

Picture 5: Existing up-lighting.




Picture 6: Proposed up-lighting.



**WILDLIFE IMPACT: Birds/Sea Turtles**
**MITIGATION STRATEGY: Lighting Minimizations**

**Recommendation:** Design to use the longest duration of time between flashes possible, thereby reducing the amount of time each light is on

**Disposition:** The LPS will incorporate lighting with 40 flashes per minute per FAA AIM versus the 60 flashes per minute or steady lights as allowable per FAA. This is the longest duration of time between flashes allowable for aircraft safety reasons.

**WILDLIFE IMPACT: Birds/Sea Turtles**
**MITIGATION STRATEGY: Lighting Minimizations**

**Recommendation:** Mount a second set of white lights pointing north/south and shielded from beach to use during migration season when conditions are suitable for bird strikes, such as during foggy nights in spring and fall (turn off the low pressure sodium lights during those conditions).

**Disposition:** This alternative was considered and studied for feasibility. However, the controls requirements, Operations and Maintenance impacts, design complications, and costs were prohibitive to implementing this strategy. A lighting systems such as this would require a controls system much more complicated than the simple circuits currently designed for the towers. The cost and time associated with the design and construction of these control systems is of concern. Additionally, the requirement for additional circuits, wiring, and components greatly complicates the electrical design of the system and nearly doubles the electrical operations and maintenance impact. In order to comply with the intent of this recommendation, however, all non-FAA lighting will be turned off during migration season and foggy nights. Non-FAA lighting will not be used unless specific tasks are occurring which require them.

**WILDLIFE IMPACT: Birds/Sea Turtles**
**MITIGATION STRATEGY: Lighting Minimizations**

**Recommendation:** Use recessed light fixtures whenever possible (those needed for illumination for workers).

**Disposition:** These lights are currently designed to be low sodium and must meet NFPA illumination standards to allow for personnel to safely walk on the platforms at night. Actual work will be done with user provided task lighting. Where possible and appropriate, the light fixtures will also be shielded and positioned to minimize ambient lighting effects. Also, the lights will be "off" by default and will be turned on/off by timer light switches to prevent the lights from being accidentally left on.

**WILDLIFE IMPACT: Birds**
**MITIGATION STRATEGY: Wire/Collision Mitigation**

**Recommendation:** Make grounding wires as visible as possible (paint bright white? made from reflective material?, etc.).

**Disposition:** To further increase the visibility of the down-conductors and overhead catenary wires, the system will use stainless steel wires that will

maintain their brightness and reflective nature. Considerations were made to paint/coat the wires, but since they are designed to conduct lightning it is necessary to keep them bare and un-coated. Coating the wires may decrease the overall effectiveness of the system. The wires will also be the largest possible diameter that is feasible for the designed towers. Finally, we will also incorporate large yellow/orange aviation markers where possible to clearly mark the presence of the wires.

**WILDLIFE IMPACT: Birds**
**MITIGATION STRATEGY: Nesting Mitigation**

**Recommendation:** Use fold-up/fold-down catwalks vs. stationary catwalks (to discourage nesting birds).

**Disposition:** These were considered in the design, but due to safety concerns with moveable platforms at extreme heights it was considered unfeasible to incorporate these. To comply with intent of this recommendation, however, the design will incorporate the minimal amount of catwalks necessary to service FAA lighting, cameras, and equipment. Additionally, steps are being taken to resolve the nesting issue operationally – by requiring scheduled inspections to prevent nesting, camera monitoring, and worker education.

**WILDLIFE IMPACT: Birds/Sea Turtles**
**MITIGATION STRATEGY: Lighting Minimization**

**Recommendation:** Lights not required by FAA should be turned off unless they are necessary for work occurring on the towers at night. Can this be automated to ensure compliance?

**Disposition:** This is already part of the design. All non-FAA lighting will be installed with timer switches to ensure they are turned off automatically after a set time.

**WILDLIFE IMPACT: Birds/Sea Turtles**
**MITIGATION STRATEGY: Lighting Minimization**

**Recommendation:** Are the requirements for FAA lights based on weather conditions or the presence of aircraft in the area? Do all of the FAA-required lights have to be on all of the time, regardless of conditions?

**Disposition:** All FAA Lighting is per the minimal FAA Specifications and in accordance with the guidance of the KSC Aviation Safety Branch. The FAA guidance does allow some flexibility is types and arrangements of lighting and a

concerted effort has been made to use the most ecological friendly types and arrangements of lights for this system. This includes, but is not limited to, longer wave lighting, color, strobe frequency, and positioning.

These recommended mitigation strategies and dispositions are current as of the date of this memorandum. Any changes to these dispositions or additional mitigation strategies will be coordinated with the NASA Environmental Program Branch.

11/23/07

Jason S. Ritter (date)
Lead Design Engineer / COTR